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THE GAS JOURNAL

NOVEMBER 26, 1930

We ask our readers kindly to note that our Telephone Numbers (2 lines) are now: Central **2236-7**

A Glance at the Contents—

Meeting of Joint Council of Junior Associations.

A Meeting of the Junior Gas Associations' Joint Council was held in London on Oct. 20, under the Chairmanship of Mr. F. S. Larkin, A.M.I.Mech.E.

Southern Association Meeting.

A General Meeting of the Association was held at Grosvenor House, Park Lane, W., last Friday—Mr. Frank H. Jones, M.Inst.C.E. (the President), in the chair. The subject of gas supply in foreign parts was discussed by Mr. George Evetts.

Presidential Address of Mr. J. W. Horwill.

Saturday, Nov. 22, was President's day of the Yorkshire Junior Gas Association, when nearly one hundred members met in Bradford. The President, Mr. J. W. Horwill, delivered his Presidential Address, and dealt with the subject of co-operation and co-ordination in the industry.

Electrical Plant as Applied to Gas-Works.

In a paper before the London and Southern District Junior Gas Association at the Westminster Technical Institute on Friday, Nov. 21—Mr. T. H. Prater, the President, presiding—this subject was discussed, with the help of a number of interesting lantern slides, by Mr. J. M. Webber, of the Croydon Gas Company.

Bromley Gasworkers' Dinner.

The Annual Dinner and Concert of the South Suburban Gas Company Social and Athletic Club (Bromley District) was held on Friday, Nov. 14, at the White Hart Hotel, Bromley, Kent. Mr. John Terrace, Chief Engineer of the Company, was present, and distributed the prizes to winners in the various sports sections.

Nottingham Gas Conspiracy Charge.

After several adjournments necessitated by exhaustive examination of accounts the further hearing of charges in relation to conspiracy to defraud and stealing money belonging to the ratepayers was proceeded with before the Nottingham Magistrates on Tuesday, Nov. 18, when eight of the nine defendants implicated surrendered to their bail.

A Smoke Abatement Campaign.

The "Manchester Guardian" for Tuesday, Nov. 18, devoted a complete page to the cause of smoke abatement, when Alderman Will Melland, J.P., Chairman of the National Smoke Abatement Society, contributed an interesting and valuable article on the subject, viewing the matter from the point of view of national economy, public health, and the domestic problem.

Society of British Gas Industries.

The Autumn General Meeting of the Society of British Gas Industries was held at the Hotel Metropole, London, on Wednesday, Nov. 19—the Right Hon. Lord Eustace Percy, M.P. (President), in the chair. The meeting was preceded by a luncheon, at which the President was also in the chair. Later, Mr. Frank West delivered an address, the main topic of which was on the subject of refractories.

The "Progas" Domestic Governor.

The success of the "Progas" system dealt with in the "JOURNAL" last week is largely dependent on the design of the governor installed. "Gas Engineer" considers this matter to-day. It was pointed out that the success of the system was largely dependent on the design of the governors installed. These should possess certain characteristics, which are summarized in the article in this issue.

Efficient and Durable Main Cocks.

A good gas cock depends primarily upon its gas-tightness, ease and efficiency of manipulation, and reliability under all working conditions. Tests carried out recently by the Industrial Research Laboratories of the Birmingham Gas Department show that Messrs. Falk, Stadelmann, & Co.'s new type of hot pressed main cocks fulfil these requirements. Some of the claims put forward by the makers for these cocks are considered in an article to-day.

Oriental Gas Company Meeting.

The Annual General Meeting of the Company was held at the London Offices, Finsbury House, Blomfield Street, E.C., on Wednesday, Nov. 9—Mr. Stanley H. Jones, M.Inst.C.E. (the Chairman), presiding. It was resolved to pay a dividend at the rate of 8 p.ct., *less* income-tax for the year, *less* 3½ p.ct., *less* tax, paid on account in May last. An Extraordinary General Meeting followed, at which a resolution was submitted for alteration of the Articles of Association of the Company, in terms of which shareholders had been duly advised.

Joint Meeting of Scottish Juniors.

The first Joint Meeting for session 1930-31 was held in Edinburgh at the Gainsborough Hall on Nov. 8. Mr. D. Yule, of Alloa, the President of the Eastern District, occupied the chair, and was supported by Mr. D. Melvin, of Uddingston, the President of the Western District. Mr. David Warden, of Dundee, read a paper in which he described some of his experiences in fitting flue pipes in unusual situations, looking at the subject from the point of view of the sheet-metal worker, and emphasizing the application of geometry to his particular problems.

EDITORIAL NOTES

In Other Countries.

THE topical and absorbingly interesting paper read by Mr. George Evetts before the Southern Association of Gas Engineers and Managers on Friday last, which will be found on later pages of our issue to-day, is divided into two parts; one deals in bare outline with the author's extensive experience of gas supply in foreign parts, while the other is a dissertation on multi-part tariffs—a question of the greatest current importance and one on which few could be better fitted to speak than Mr. Evetts. At the commencement of his paper the author gives a most valuable table relating to the sale of gas per consumer and per head of population in various parts of the world; and this table is significant of the world-wide strength of the gas industry, and of the fact that, in all manner of different circumstances, gas is the modern fuel. Without falling into error, it is difficult to draw accurate comparisons between the consumptions in various places, for the sale per consumer is not a complete guide to the extent of the utilization of gas in any particular community.

The comparison between London and New York is, however, valid enough in general terms, and it shows the increase in gas usage which we may expect in this country when legislation is rendered fairer and when the public react more strongly to more extensive propaganda. And once again it indicates that we have no need to feel depressed about the growth of electricity. New York—one of electricity's heavens—shows a figure of 45,000 c.ft. per annum. Exclusive of public lighting, Calcutta has a sale per consumer of 69,300 c.ft., which demonstrates at any rate that those who do employ gas appreciate its services. It is interesting that public lighting in that city accounts for nearly 47 p.ct. of the load. Presumably including public lighting, Rio de Janeiro has the remarkable figure of 67,000 c.ft. per consumer per annum. There is obviously no need for pessimism regarding the future of the gas industry, particularly when it is remembered that in South America the gas and electricity undertakings are frequently under the same control—as is the case with Rio de Janeiro—while in the United States the admirable system of joint control is very extensive.

In common with Mr. Frank West, with whose address before the Society of British Gas Industries we shall deal later, Mr. Evetts believes that the gas industry of this country could learn many useful lessons from the organization of the American Gas Association, which is all-embracing. In this respect—and we thoroughly agree with him—the author welcomes the introduction of gas contractors into the Institution of Gas Engineers; it will accelerate the co-operation of all bodies within the industry. Among many practices which impressed Mr. Evetts during his tour of the various countries were the large numbers of tankless holders and meters of the "Connersville" type in North America; the competition from distributed steam in New York; and the absence of the prepayment meter from both North and South America. In both North and South America, he observes, gas manufacturing and distribution plant is highly efficient. In India, which as far as gas is concerned implies Calcutta and Bombay, a large business in hot water heating by gas, in addition to gas for cooking, is anticipated. In Belgium there is a coke oven plant functioning purely as a gas-works, and in a year's time it will be making about 20 million c.ft. a day for supply to a grid system. An unusual feature of this plant is a set of purifiers dealing with 14 million c.ft. a day, with air-blowing plant for revivification in the box; and it is expected that the oxide will be fully fouled with one charging. In Bucharest, enthusiasm has dwindled: and, because no apparent effort is made to push gas, the sales are dwindling too. Within forty miles of Bucharest, natural gas is sold at 1·3d. per therm for domestic purposes, and at less than half this for industrial use—and even so the author was asked to advise on a variable tariff to attract the large industrial consumer! We have selected the foregoing striking facts at random to indicate that Mr. Evetts' paper can only be described as fascinating. It will, we are sure, be enjoyed by all our readers.

Tariff-Framing.

WHAT Mr. Evetts has to say on this subject shows how complicated the problem is; but it is capable of solution, and the Americans "are now satisfied that they can frame a form of tariff which is equitable, politic, and sufficiently attractive to bring increased business and meet competition." The basis of all multi-part tariffs is, of course, to do justice to the good consumer by making all consumers bear their fair burden of cost. When steps were first taken to put this idea into practice in the United States there was the customary objection to any change; but after some time the Public Utility Commissioners—who correspond to our Board of Trade and Parliamentary Committees—became enthusiasts; and in one State the flat rate is condemned. This is significant.

Mr. Evetts regards the matter in four stages. First of all, a flat-rate system of charge, coupled with a scale of discounts, does not fully compensate for the difference in actual cost to the undertaking of the various consumers; some consumers are being supplied at a loss, and a proportion of these at such a loss that the undertaking would be better off without them. Secondly, the flat rate does not assist development of business; experience has already provided ample proof that a multi-part tariff acts as an incentive to increased consumption. Thirdly, the policy of change is justified; to give the large consumer fair terms the unprofitable consumer must be eliminated. Finally, the author deals with the fundamental considerations involved in framing a new form of tariff, and he puts forward many valuable suggestions which demand the closest study, and a few of which we will emphasize here.

One of the most important aspects of the matter is the unprofitable consumer—which does not imply the consumer with small means. There are several points to bear in mind. There is the fact that capital has already been spent on the consumer which is not recoverable, and it may be better financially and politically to have certain consumers on the mains than as derelicts, although new ones of this nature would not be connected up. Then, new consumers should never be given the advantage of capital spent on the existing ones. "It is often argued that a new consumer should escape capital charges if no new plant is needed, or no new mains. The saving should go towards an all-round reduction when the volume of new business warrants it, not to the newcomer only. It may be suggested that the undertaking would be better off with the newcomer than without him, but the true test is to take hundreds of prospective consumers of such a nature, and then see whether the undertaking would be better off. . . . On the district we wish to see the valley of the output curve filled in, because the distribution, operating, and capital charges can be reduced to all. Assume that one customer comes along and fills in the valley completely, and is given special terms. Immediately the basis becomes changed, and any consumer offering business to an undertaking with a flat output line is an embarrassment." The unfairness of giving the last comer the advantage of capital already expended cannot be over-emphasized. Mr. Evetts then considers the offering of special terms for certain loads. Suppose, he

says, that in order to build up a load a prospective consumer is offered terms which do not cover the correct proportion of all the costs, but on such terms that the finances of the undertaking are improved. Other consumers could then claim that they are equally valuable for the load curve, and threaten to take away their business unless the same terms were offered. "Therefore, the relative value of new load is continually changing, and the actual system would probably consist of a combination of economics and policy, both factors being liable to abrupt changes. . . . In framing a tariff care should be taken to deal with all consumers alike who take gas in like circumstances. The discounts should apply to the amount of gas used and the load factor, and not to a particular trade as such. We should then avoid anomalies, such as the fish fryer getting an industrial discount when he takes less gas than a good domestic consumer and offers a worse load factor."

Institution Benevolent Fund.

On two occasions recently reference has been made in these columns of the "JOURNAL" to the need for more material support being accorded the Benevolent Fund of the Institution of Gas Engineers; but the Autumn Research Meeting of that representative organization of the technical side of the industry provides a still further opportunity of which one feels called upon to take advantage, even at the risk of seeming to importune readers. A good cause has too often been the excuse for a bad action; but the action of repeatedly calling attention to so deserving a matter as this, is one which leaves the writer with a clear conscience. An additional incentive to a renewal of the plea is afforded by last Friday's meeting of the Southern Association of Gas Engineers and Managers, at which Mr. C. Valon Bennett, of Rochester, who, on behalf of the Management Committee, is actively engaged in trying to secure additions to the fund, stated some strange facts—facts, be it said, which were neither gratifying to Mr. Bennett nor flattering to the "JOURNAL," which has so closely identified itself with the campaign.

Briefly, the facts are that some couple of months ago Mr. Valon Bennett sent out 748 letters of appeal for subscriptions to the Benevolent Fund; but though each letter was accompanied by a stamped addressed envelope, he received only 160 replies. Subscriptions have been received from 135 of the persons appealed to; the total amount of money raised being £88 11s. 6d. He would naturally like to hear from the other 600 people to whom he wrote. At the end of 1929, the membership of the Institution was 1405, but of this number only 518—little more than one-third—subscribed to the Fund. The outcome was that, while the total amount received during that period by way of subscription was no more than £342, in the same time there was expended in grants a sum of £540. Much better support than this is needed, and it is for the members to see that it is forthcoming. The times are hard for those who fall out of place in the ceaseless struggle, as well as for those who through no fault of the bread-winner may be left unprovided for; and the Management Committee of the Fund find themselves grievously hampered by the extreme paucity of the material support that is vouchsafed them. They should not be thus hampered.

While taking a ramble through the beautifully laid-out and perfectly maintained village for old people, established amid glorious country scenery at Hersham, Surrey, and supported on model lines, out of a munificent bequest made for the purpose by the late William Whiteley, the writer reflected upon the peculiar readiness with which hundreds of thousands of people—many, probably, who can ill-afford it—will send along their ten-shilling notes for a sweepstake (with hospital benefit attached), when the size of the pool gives them but a remote chance of securing a lucky number. The Institution members cannot be expected to erect a village, nor presumably can they run a sweepstake. They can, however, do more for their unfortunate fellows than they are doing, and they should do it.

Co-Operation and Refractories.

A STRONG plea for further co-operation between the various organizations of our industry was made by Mr. Frank West, Chairman of Council of the Society of British Gas Industries, at the Autumn Meeting of the Society on Wednesday last. There is, he suggests, nothing like sufficient co-ordination to-day, though we think he will agree with us that enormous advance in this direction has been made during the post-war years; one has only to consider for a moment the truly representative nature of the various Committees which deal with such matters as research, publicity, standardization, and so on, to realize that the activities of these Committees do in fact represent the industry as distinct from merely isolated parts of it. What Mr. West desires, however, is a co-ordinated convention of every body connected with the industry, on the lines of the annual convention of the American Gas Association, so that the voices of the industry may be more in unison. To his mind the present system of separate annual meetings for each body results in wastage of time, effort, and money. We believe, however, that there is closer co-operation in our industry than appears on the surface, but, at the same time, we agree that this co-operation would be more effective if it followed more closely the practice of the American gas industry. It would to-day take little effort, comparative with that which would have been necessary only a decade ago, to bring about a more tangible and effective co-operation such as is suggested by Mr. West. Such co-ordination, too, would render it easier to establish a National Laboratory such as that at Cleveland—a matter which ought to be tackled at once by our industry if only because its conclusions would carry real weight in Governmental circles.

In fostering co-operation, the Society of British Gas Industries has a record of which it may well be proud. The Society assisted the Institution of Gas Engineers in the formation of the British Commercial Gas Association; it contributed handsomely to the establishment of the Livesey Professorship of Coal Gas and Fuel Industries at the University of Leeds; it did good service in the formation of the National Gas Council; and—to mention one further example—it has done, and continues to carry out in increasing measure, excellent work on the problem of standardization. An outline of this work, reinforced by a chronological table and an appendix to his Address as Chairman of Council, is given by Mr. West. But, in keeping with his ideas of co-operation of the gas industry as a whole, he puts forward the view that the Society itself could do more to assist the industry—in particular, the B.C.G.A. He points out forcefully that it is clearly in the interests of the Society to support more strongly the publicity efforts of the Association; for, if, through lack of propaganda, the false idea is allowed to gain ground that gas is out of date—that our industry is failing to offer the best medium for the scientific utilization of coal and the best and most economical methods of lighting, heating, and cooking, then obviously the interests of the manufacturers of gas-making and distributing plant, and of gas-using appliances generally, will be injured. Hence Mr. West urges all members of the Society to subscribe as much as they possibly can to what he terms the "first line of defence of the gas industry."

Turning to the important subject of refractory materials (of which Mr. West—as Managing-Director of the Derbyshire Silica Firebrick Company, as a Past-President of the Refractories Association, and in other capacities—has a most extensive knowledge), he takes as his major theme the standardization of shapes. This question, he observes, "has been brought before many of our technical associations from time to time, but up to the present practically nothing has been done." Lack of standardization necessarily means a higher cost of refractories to the gas industry, which to-day absorbs refractory goods to the value of about a million pounds sterling. "In many cases, in a new design of retort settings or furnaces, a complete set of new shapes is designed, which might not be necessary if more attention were given to existing shapes, using them again wherever possible." Moreover, such standardization would enable the manufacturer to carry stocks and thus speed-up delivery. There is everything to be said for taking standard shapes and sizes as

far as possible as the basis for new designs of plant; and the problem is undoubtedly worthy of greater consideration than it has had up till now. Not unnaturally, Mr. West mentions the marked advances in the production of refractory materials during recent years. As indication of these advances he calls attention to the great increase in the average life of retorts. In 1910 the average working life was given as 1250 days; in 1927 Mr. Stephen Hay, in his paper before the Southern Association of Gas Engineers and Managers, gave 2000 working days as the life of silica retorts operating at higher temperatures and greater outputs of gas. For such results Mr. West rightly claims that credit is due to the manufacturers, though, in fairness, credit ought also to be given to the greater efficiency in carbonizing practice. As to the former, it is significant of modern ideas that a moderate sized refractory works will spend £2000 to £3000 a year on investigation work alone. The full benefits of this expenditure can only be gained by close co-operation between producer and buyer, just as the full benefits of the various organizations in the gas industry can only be gained by close co-ordination of effort.

Gas Companies' Protection Association.

It was unfortunate that Mr. R. W. Edwards was not well enough to be present to deliver in person last Thursday the address which he had prepared as Chairman of the Gas Companies' Protection Association; but his place was well filled by Mr. R. Bruce Anderson, the Vice-Chairman, who added some comments of his own while reading the address. No year can be really uneventful so far as public utility undertakings of the importance of gas companies are concerned; and the twelve months to last September provided their own point of interest. It has, in fact, been a somewhat critical period; and the Chairman perceives, as others perceive with him, that, if the progress of the past is to be continued, there must be an increase, rather than any lessening, of energy and watchfulness. The gas industry, and every other industry, will be helped by those who, facing the facts, still have faith in the outcome; there is no salvation to be found in that "breezy optimism" which so often is preferred to the less pleasant alternative of looking the facts in the face. If every period introduces its own problems, every problem brings in its train such knotty points for gas companies as Mr. F. E. Cooper, the Secretary of the Association, has qualified himself by close study and long experience to unravel.

With commodity prices at levels lower than twelve months ago would have been regarded by most people as possible, with unemployment figures at a level higher than any thinking person can regard with equanimity, the industrial life of the country is up against possibilities of fresh trouble at two vital points. As if things were not already bad enough! And to complete the story, Government-subsidized Grand Opera is promised! Already users of the railways have been heavily hit by increased charges, while the prosperity of the coal industry appears to be in inverse ratio to the price of the commodity; yet these are the two directions in which unsettlement is apparent. With the latter Mr. Edwards deals in his address, and since that was written the Coal Mines National Industrial Board under Part IV. of the Coal Mines Act, 1930, has been constituted. With reference to this matter, "The Times" on Saturday said: "There is believed to be a possibility of the Board's making a general recommendation of an interim character that may avert the danger of stoppages of work." In so far as this danger is real, there is, of course, no time to lose, as the seven-and-a-half-hour day comes into force on Dec. 1. Commenting upon this part of the address, Mr. Bruce Anderrson said the gas industry hardly knew whether it was faced with a strike or not, but anyway the Act had caused many undertakings to incur a big premium for insurance, by laying in heavier stocks of coal than would be necessary if they "had only to consider the Acts of Providence, and not the Acts of irrational man."

For many matters which are touched upon by Mr. Edwards, readers may be referred to the full report of the proceedings at the meeting of the Association which appears on later pages of this issue; but it may be mentioned here that he particularly stresses the need for new gas legislation—the only barrier to progress and success being "the statutory cloud of out-of-date legislation." The recent Newcastle Act suggests that undertakings are already being driven to obtain individually, and at great expense, powers which should be granted to all. The more the industry can show its desire for this new legislation, the stronger will be the case of those who have in hand any negotiations to that end with the authorities.

The Gas Unit.

THAT interest was aroused in the suggestion put forward by Mr. R. D. Keillor and by Messrs. Radiation Limited that a smaller gas unit than the therm should be introduced was proved by correspondence which subsequently appeared in the pages of the "JOURNAL." These letters showed that the question was one which could be viewed from more than one standpoint, and therefore the further references that have been made to the matter at meetings during the last few days will be welcomed. The occasions were two, and both are reported in this issue of the "JOURNAL."

Presiding at the meeting of the Gas Companies' Protection Association, Mr. R. Bruce Anderson, the Vice-Chairman, said it seemed very natural to adopt a Gas Unit containing the same energy as the Electrical Unit, which would make prices of gas and electricity directly comparable. As to this, Mr. C. F. Botley retorted that he thought it would be altogether premature on the part of the gas industry to introduce any new unit; the therm itself was not yet thoroughly understood. He protested against the introduction of a new small unit, as being a step which he thought could lead only to confusion. Again, at the meeting of the Southern Association of Gas Engineers and Managers, Mr. H. C. Smith, who has been elected President for next year, raised the same point—that comparison was complicated by the great difference in size of the Electrical Unit and the Gas Therm. He said he regarded the proposal as worthy of careful consideration, and in this connection made what seems to us one of the strongest possible points. As has been recorded in our pages, two undertakings already have adopted Gas Units of different sizes, and it will certainly make things easier for everybody if, should a smaller unit be found generally advisable, a single size is agreed upon for the purpose. Mr. Smith urged that the National Gas Council should consider the matter immediately, and to this Mr. Botley replied that they were doing so—"meanwhile he did hope the industry would not be led into a side avenue by establishing a fresh unit." Here, then, the matter may be left for the present. The doubt in our own mind is whether some people have not in view a smaller unit in substitution for the therm, while others are discussing and putting into operation a smaller unit in addition to the therm.

Mr. Evetts on Multi-Part Tariffs.

It has been thought that there may be wide desire to study the paper contributed by Mr. George Evetts at last week's meeting of the Southern Association of Gas Engineers and Managers (as reported in to-day's issue), and in view of this, we are asked by the Hon. Secretary of the Association (Mr. J. H. Donaldson, of Sevenoaks) to intimate that, should such desire be manifested, he will be pleased to arrange for the printing of bulk supplies, and their allocation at cost price.

Dyestuffs Act.

From a statement made by Mr. William Graham (President of the Board of Trade) in the House of Commons last week, it is to be gathered that the Government have decided to allow the Dyestuffs (Import Regulation) Act to expire on the date contemplated when it was passed ten years ago—that is to say, on Jan. 15, 1931. The Act provides for the safeguarding of the dye-making industry by a system of prohibition, subject to

licensing; and though there are differences of opinion as to the advisability of continuing the Act in operation, there seems to be only one view as to the great advantage which the industry has already derived from the protection afforded by it. According to Mr. Graham, the report of the Dyestuffs Industry Development Committee shows that the industry has now reached the stage when it is capable of meeting a very large proportion of the requirements of dyestuffs users in the United Kingdom, and of carrying on an increasing export trade; while the manufacturers have indicated their ability to meet normal foreign competition in respect of prices. "The Times," on the other hand, declares that "to allow the Act to lapse is a retrograde step," and finds it "impossible to believe that the Government can have realized how far-reaching will be the results of checking a movement of such bright promise for British industry."

PERSONAL

Mr. ANGUS LEITH MACMILLAN, M.A., LL.B., who was formerly with the Aldershot Gas, Water, and District Lighting Company, has been called to the Bar, at Gray's Inn.

Mr. CHARLES F. RATCLIFFE, J.P., Managing Director of Messrs. Brotherton & Co., Ltd., has been elected Chairman of the Company, in place of Lord Brotherton, deceased.

Mr. E. Shinwell, M.P., Secretary for Mines, announces that he has appointed Dr. C. H. LANDER, C.B.E., Director of Fuel Research at the Department of Scientific and Industrial Research, to be an additional member of the Safety in Mines Research Board.

At the Plymouth and Stonehouse Gas Company's works at Coxside on Thursday, Nov. 20, Mr. W. WARD, the Foreman, on retiring after 56 years in the Company's service, was presented with a wallet of banknotes and an easy chair upholstered in cow-hide. The presentation was made by Mr. R. J. H. Clark, the Company's Engineer.

Prof. J. W. COBB, Livesey Professor of Coal Gas and Fuel Industries at the Leeds University, has been appointed the representative of the University on the board of management of the Leeds Modern School—the school at which Prof. Cobb was himself educated originally. It was in 1920 that Prof. Cobb became Dean of his Faculty, and in 1925 he was made Pro-Vice-Chancellor of the University.

OBITUARY

We are informed that the death has taken place, on the 16th inst., of Mr. A. C. WRIGHT, representative of Messrs. Spencer Chapman & Messel, Ltd., of Seething Lane, E.C. 3. He will be succeeded by Mr. L. L. Alderton.

The death has occurred of Police-Judge STEPHEN ANDERSON, a Director of Hawick Gas Light Company, Ltd. Mr. Anderson, who was aged eighty-three, retired a short time ago from Hawick Town Council, after 40 years' service as Councillor, Magistrate, and Police-Judge.

THE LATE MR. T. H. MARTIN.

Last Thursday, Nov. 20, the funeral took place of the late Mr. T. H. Martin, who, as announced in last week's "JOURNAL," died on the previous Sunday at "Windermere," Mount Pleasant Road, Hastings, where he had lived for a number of years.

A short service was conducted at the house by the Minister of Mount Pleasant Congregational Church, the Rev. Arthur Collins-Williams. The mourners who proceeded with the cortége to the Great Northern Cemetery, New Southgate, where the interment took place, were two of his three sons (Mr. E. H. Martin, Managing Director, Engineer, and Secretary of the Harpenden District Gas Company; and Mr. A. T. Martin), his son-in-law, Mr. Vasie Simons, and Mr. Walter T. Dunn, ex-Secretary of the Institution of Gas Engineers. At the graveside were Mr. Jasper Rowley, son-in-law; Mr. C. Holmes Hunt, Vice-Chairman of the Harpenden District Gas Company; and a number of the staff and workmen of the Company, including Messrs. W. F. Hillier, F. Roberts, and Golding, Messrs. Harvey and Payne represented the Barnet District Gas and Water Company, and Mr. W. T. Dunn the Evening Star Lodge.

The accompanying portrait is from a photograph taken in Mr. Martin's garden, and depicts our old friend in one of his characteristic attitudes. It will be valued, we are sure, by his many friends in the gas industry, in which he worked successfully for so many years.

FORTHCOMING ENGAGEMENTS

Nov. 29.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION (AUXILIARY SECTION).—Meeting at the Gas Office, Newcastle-on-Tyne, 2.30.

Dec. 2.—BRITISH COMMERCIAL GAS ASSOCIATION.—Sub-Committee on Education for Gas Salesmen, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 3.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to Gas Light and Coke Company's Meter Works at Willesden.

Dec. 6.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Meeting and Visit to Gas-Works, St. Andrews.

Dec. 6.—MIDLAND JUNIOR GAS ASSOCIATION.—Visit to Cannock and Rugeley Collieries, Hednesford.

Dec. 6.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Paper by Mr. W. A. Currie, of Glasgow, on "Continuous Verticals."

Dec. 6.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Visit to Messrs. J. & J. Braddock's, Globe Meter Works, Oldham. Paper by Mr. E. S. Davies, of Stretford, on "Waste-Heat Boilers with Horizontal Settings."

Dec. 6.—WESTERN JUNIOR GAS ASSOCIATION.—Visit to G.W.R. Gas-Works, Swindon.

Dec. 9.—INSTITUTION OF GAS ENGINEERS.—Meetings of the Executive Committee, 10 a.m.; Finance Committee, 12 noon; Education Executive Committee, 4 p.m., at 28, Grosvenor Gardens, S.W. 1.

Dec. 9.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1.

Dec. 10.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to Messrs. G. & J. Weir, Ltd., Cathcart, Glasgow.

Dec. 11.—MIDLAND JUNIOR GAS ASSOCIATION.—Paper by Mr. J. H. Wainwright, of Halesowen, "An Automatic Seal Arrangement for C.W.G. Plants."

Dec. 12.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Two short Papers—(1) "Refrigeration," by Mr. L. W. Andrew, B.A., B.Sc.; and (2) to be arranged later.

Dec. 13.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Leeds. Paper by Mr. L. Hartley (Messrs. Clayton, Son, & Co.) on "Waterless Gasholders."

Dec. 16.—SOCIETY OF BRITISH GAS INDUSTRIES.—Meeting of Council in the afternoon.

Dec. 17.—BRITISH COMMERCIAL GAS ASSOCIATION.—Executive Committee, 11.30 a.m.; General Committee, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

THE NEWS OF THE WEEK

Inspection of the Gas-Works at Penrith by members of local societies, clubs, schools, or groups of ratepayers is to be invited by the Gas Manager, who has been authorized by the Penrith Urban District Council to make all arrangements for personally conducting such inspections.

Among the Relics of the ill-fated Andrée expedition, which, with the body of the explorer himself, were recently found, was Andrée's diary, and attached to it a " Koh-i-Noor " pencil. It is particularly interesting, that after such a long period (more than 33 years) in such abnormal conditions, the pencil should be found, and the records made with it readable from beginning to end, and that Andrée should have chosen the " Koh-i-Noor " to take with him.

A Ministry of Health Inquiry has been held at Middlesbrough into an application by the Town Council to borrow £50,000 for the erection of a new gasholder. It was stated that the gas storage at present was 5,700,000 c.ft. a day, but that gas was obtained from an outside source and was not under the control of the Town Council. The maximum amount delivered was 4,500,000 c.ft. a day, and it was estimated that at the present rate of increase the amount of gas required in seven years' time would be 5,700,000 c.ft. a day.

A Memorial to East Greenwich Employees of the South Metropolitan Gas Company and to parishioners who lost their lives in the war, was unveiled last Sunday by Dr. Charles Carpenter, C.B.E., the President of the Company, at the Church of St. Andrew with St. Michael, Tunnel Avenue, S.E. The ceremony took place at the eleventh annual service of Remembrance, and the Memorial was dedicated by the Bishop of Woolwich, who also preached the sermon. The Metrogas Military Band played at the Service, which was conducted by the Vicar, the Rev. F. Challoner. The Company's Choral Society led the singing. Large numbers of ex-service men, co-partners, and their wives were present.

£930 Worth of Appliances were disposed of during the recent cookery demonstration and exhibition of gas appliances at Heywood, noted in the " JOURNAL " for Nov. 19. The week's exhibition was stated to be an outstanding success from every point of view; the Cookery Demonstration Hall was filled to overflowing at every session. The Gas Committee at a meeting held on Nov. 19 passed a resolution placing on record the appreciation and thanks of the Council to the Manager and staff for their efforts in making the enterprise so successful. The firms co-operating included Messrs. J. Wright & Co., Richmond's Gas Stove Company, General Gas Appliances, Ltd., Cannon Ironfoundries, Ltd., Geo. Bray & Co., and W. H. Dean & Son, Ltd.

Bognor Stock Issue.—As will be seen from our advertisement columns, Messrs. A. & W. Richards, of 37, Walbrook, E.C. 4, are offering for sale by tender, on behalf of the Directors of the Bognor Gas and Electricity Company, £20,000 additional ordinary consolidated stock " A," ranking for a standard dividend of 5 p.ct. subject to the sliding scale equally with the existing similar stock which has for the last two-and-a-half years received a dividend of 8 p.ct. per annum. The minimum price of issue is £120 per £100 stock, yielding at that price £6 13s. 4d. p.ct. The minimum amount of stock which may be tendered for, or will be allotted, is £50; above this, tenders may be in multiples of £5. Tenders for this issue should be received not later than 11 a.m. on Thursday, Dec. 4.

" The Romance of a Lump of Coal " is the title of a lecture to be delivered by Sir Francis Goodenough, accompanied by demonstrations, at the Caxton Hall, on Monday, Dec. 8, at 6 p.m., on behalf of King Edward's Hospital Fund for London. The lecturer will describe how at the gas-works there is extracted from a lump of coal the sunshine of bygone ages; how a myriad of commodities vital to the industries and to the safety of the nation are obtained; and how the industry is of service to home, hospital, and factory. The chair will be taken by Sir Richard Gregory, D.Sc., LL.D. (Editor of " Nature "). Tickets (5s. reserved, 2s. 6d. unreserved) may be obtained from Alfred Hays, Ltd., 26, Old Bond Street, W. 1, 62, Strand, W.C. 2, and 74, Cornhill, E.C. 2; J. & E. Bumpus, Ltd., 350, Oxford Street, W. 1; W. & G. Foyle, Ltd., 121, Charing Cross Road, W.C. 2; The Secretary, King Edward's Hospital Fund for London, 7, Walbrook, E.C. 4; or at the doors.

Kidderminster Stock Issue.—As will be seen from our advertisement columns, Messrs. A. & W. Richards, of 37, Walbrook, E.C. 4, are offering for sale by tender, on behalf of the Directors of the Kidderminster Gas Company, £20,000 5½ p.ct. redeemable debenture stock, at a minimum price of issue of par, to be redeemed on Dec. 31, 1950. The minimum amount of stock which may be tendered for, or will be allotted, is £100; above this, applications must be in multiples of £1. Tenders should be received not later than 11 a.m. on Wednesday, Dec. 10.

South Suburban Stock Issue.—As will be seen from our advertisement columns, the South Suburban Gas Company are offering for sale by tender £200,000 5 p.ct. perpetual debenture stock, at a minimum price of issue of £99 per £100 stock, to rank *pari passu* with the existing stocks of the Company; also £300,000 5 p.ct. perpetual preference stock, at a minimum price of issue of £92 per £100 stock, to rank after the perpetual debenture stock. Tenders for these issues, in amounts of £10 or multiples thereof, should be received by the Company, Lower Sydenham, S.E.26, on or before Dec. 1.

Dr. Barnardo: Physician, Pioneer, Prophet.—This book, to be published on Dec. 2 by George Allen & Unwin, Ltd., at 7s. 6d. net, has been written by Dr. J. Wesley Bready, M.A., B.D., Ph.D., and relates all the pertinent facts associated with the supreme achievement of Dr. Barnardo—known the world over as " the Father of Nobody's Children." Opening with an historical introduction, the book traces the evolution of Dr. Barnardo's work through a tiny donkey-shed ragged school to an organization which has influenced legislation throughout the world. The titanic battles Barnardo had to fight against prejudice, bigotry, and antiquated laws make the record of his victory an epic story. Dr. Bready's book unfolds the whole romance of Barnardo's work. It should be welcomed, not only by educationalists and social workers, but by all who believe in giving the child a fair start in life.

The Colonial Gas Association submit the following forty-second annual report for the year ended June 30 last: After deducting £10,151 for depreciation, the balance at credit of revenue account is £112,474. Adding the balance brought forward from last year—viz., £14,129—and deducting bank, loan, and debenture interest, and after payment of interim dividends of 4 p.ct. and 4½ p.ct. in April last on preference and ordinary shares respectively, the amount at credit of the net revenue account is £60,286. The Directors recommend as follows: (*a*) That a dividend at the rate of 8 p.ct. per annum (*less* interim dividend of 4 p.ct. for the half-year ended Dec. 31, 1929) be paid on the preference shares; (*b*) that a dividend at the rate of 8 p.ct. per annum (*less* interim dividend of 4½ p.ct. for the half-year ended Dec. 31, 1929) be paid on the Ordinary shares; (*c*) that £8000 be set aside for Australian income-taxes on profits earned to June 30, 1930; and (*d*) that the balance (approximately £19,114) be carried forward to the next account. The sales of gas show an increase of 2·8 p.ct. over the sales for the preceding year. The increase in sales of gas from Subsidiary Gas Undertakings was 3·7 p.ct.

Explosion at Fulham Gas-Works.

An explosion occurred on Saturday, Nov. 22, at the Fulham Works of the Gas Light and Coke Company. No one was injured, and, apart from some broken windows on the works and in the neighbourhood, and the rending up of 50 yards run of concrete paving above a pipe culvert, all the damage was confined to a localized section of the washing and purifying apparatus.

It would appear that the explosion resulted from the ignition of a gas-air mixture in the vaults below two sections of purifiers, the gas responsible having escaped from a blowing seal pot situated in these vaults. Two cast-iron purifiers were wrecked, several gas mains cracked, and a number of small tar, liquor, and water pipes in the culvert were broken. Minor damage was done to a rotary washer and to some condensers.

The subsequent outbreaks of fire and escapes of gas were completely dealt with within ten minutes. At no time was the supply of gas endangered, while the manufacture of gas was continued upon unaffected sections.

New Meter Testing Station at Coventry.

A new gas meter testing station for Coventry was opened on Monday last week by the Mayor of Coventry (Alderman W. E. Batchelor). Hitherto gas meter testing has been carried out in part of the works of Messrs. George Wilson Gas Meters, Ltd. This work has grown considerably of late years, and new premises were required to enable the testing to be more effectively carried out.

The new building is in Livingstone Road. It is single storey and comprises office and workshop accommodation and staff room at one end, the other end being specially adapted for testing gas meters.

Alderman Sage, in presenting a gold key to the Mayor, pointed out that gas meter testing in Coventry commenced in 1903, when the George Wilson Gas Meters, Ltd., opened premises, now occupied by Courtaulds, at the Prince William Henry Bridge. Fifty-seven meters were tested in the first year, and the testing fees amounted to £1 17s. 6d. The work steadily increased until in 1920 the meters tested numbered over 12,000, and the fees amounted to £436. The Gas Regulation Act of that year necessitated a thorough overhauling of the methods and equipment for testing, and the Gas Committee also commenced repairing their own meters. A test room was procured on Messrs. Wilson's works. In 1928 the Committee were satisfied that new premises must be found, and they had built these at a cost of £2878.

Mr. A. McI. Cleland Lectures at Belfast.

"Gas Manufacture and the Evolution of the Gasholder" were the subjects of a lecture by Mr. A. McI. Cleland, M.Inst.Gas E., Distribution Superintendent to the Belfast Gas Department, before a representative gathering of the technical section of the Association of Engineering and Shipbuilding Draughtsmen in Belfast. Mr. James Young, Divisional Organizer, Glasgow, was in the chair.

Mr. Cleland stated that gas manufacture is largely a chemical process, the principles of which have remained unaltered since the early days, taking the form of destructive distillation of coal. The coal is heated in retorts in a dry state, and the greater part of the carbon—of which good coal contains about 86 p.ct.—remains behind in the form of coke or gas carbon. Of every ton of coal heated in a closed vessel or retort, 13 cwt. is left behind, and the remaining 7 cwt., consisting of heavy vapours and oils, are condensed and form the black, shiny liquid known as coal tar. Numerous non-illuminating gases and other impurities, such as ammonia and sulphuretted hydrogen, are removed after the heavy vapours leave the retort, either from the point of view of profit—the bye-products obtained from coal being very numerous and valuable—or because they are deleterious to health.

The lecturer then discussed the relative merits of regenerative furnaces; inclined retorts, stationary and revolving; vertical retorts and continuous charging, also mechanical stoking. The quantity or volume of gas resulting depends on the quality of the coal used in the retorts, as well as the type of retort, and varies from 9000 to 16,000 c.ft. of gas per ton of coal burnt. He then reviewed various designs of gasholder, including the waterless type, of which Chicago has the largest, being of 20 million c.ft. capacity.

Lantern views of this type of holder were shown. An interesting discussion followed.

On the motion of Mr. J. Corcoran, seconded by Mr. J. F. Herd, a vote of thanks was passed to the lecturer.

Gas-Works Power Plant.

The most economical means of providing power for gas-works, state Messrs Belliss & Morcom, Ltd., of Birmingham, in a recently published brochure on the subject of gas-works power plant, is by independent generating plant, which enables the various sources of heat to be utilized which otherwise would be wasted. Consequently, the plant is usually steam driven, the prime mover being either a reciprocating engine or a steam turbine, both types being manufactured by the firm.

The brochure illustrates typical examples of plant in operation at some of the largest gas-works in the country, including a "Belliss" turbine at Sydenham; a 750-KW. turbo alternator at Fulham; engine-driven generators at Bow Common; 2 200,000 c.ft. per hour compressor at Bath; 300,000 c.ft. per hour machines at Windsor Street Works, Birmingham; and other apparatus of a similar nature.

"Belliss" plant, state the makers, is used for a variety of purposes in connection with gas making, and the large number of steam engines, steam turbines, and compressors still in useful and economical service after over twenty years of life testifies to the success obtained. In this connection mention is made of such performances as "Belliss" engines of large size which have been certified to run non-stop without a shut-down of any kind for periods of over three years; and other cases where engines are locked up nightly to run throughout the night without any attention whatsoever.

"Belliss & Morcom" plant is used in gas-works for driving electric generators, pumps, fans, boosters, compressors, and auxiliaries generally, also for compressing gas for high pressure services and for long-distance transmission. In the pages of their brochure, the firm have endeavoured—chiefly by illustration—to give a fuller idea of this plant in service.

An Aviation Landmark.

The Castleford and Whitwood Gaslight and Coke Company have made an excellent move for the assistance of aviation by having the name of "Castleford" painted in large letters across the top of their largest gasholder, which is about 100 ft. in diameter.

Castleford is practically in a direct line for the Sherburn Aerodrome when aviators are going north, and, in addition to the name of the town, further assistance has been rendered to them by the painting of a large arrow pointing directly to Sherburn, the name of which appears within the large arrow head.

Mr. W. R. Gill, one of the Directors of the Castleford Company, is also Chairman of the Yorkshire Aeroplane Club, whose headquarters are at Sherburn; and the lettering was plotted out by Mr. G. F. Twigg, the Manager and Engineer to the Company. With normal visibility the name can be seen at a height of 8000 ft. The letters are 15 ft. long, 6 ft. wide, and 2 ft. broad, the arrow-head being 15 ft. wide at the broad end, and the word "Sherburn" being in 2 ft. letters within.

Bromley Gasworkers' Dinner.

The Annual Dinner and Concert of the South Suburban Gas Company Social and Athletic Club (Bromley District) was held on Friday, Nov. 14, at the White Hart Hotel, Bromley, Kent. Mr. W. M. Judd, Local Manager, presided, supported by Mr. J. Terrace, Engineer, Mr. F. J. Gorman, Assistant Engineer, Mr. G. Manley, Mr. J. Isard, Secretary of the Club, and a company of over 120.

The Toast of the Social and Athletic Club was proposed by Mr. H. Sumner. "This year," he said, "we have broken all our previous records. We have always had one great ambition—to see all our sections represented in our list of cups. This year that ambition has been realized, and every section has brought home a trophy."

"This year also," continued Mr. Sumner, "we joined the South Suburban Gas Company Guild and won the championship. If our members still maintain that true spirit of sportsmanship there is no reason why those successes should not be renewed. I couple with the toast the name of our Chairman, Mr. W. M. Judd."

Mr. J. Isard, Secretary, responded for the Club, and read the list of trophies won during the year.

Mr. A. E. King was the winner of Dr. C. Carpenter's cup for the champion athlete of the Guild.

Mr. Terrace, responding to the Toast of the Presidents and Vice-Presidents, proposed by Mr. Manley, said that he thought one of the reasons for the Club's successes was that they had made up their minds to take their sport seriously, which was one of the essentials of sportsmanship. The Chairman of the Company believed that the employees should be provided with the means of enjoying themselves and maintaining their health. He found that while larger depôts had all the necessary facilities the Bromley depôt, which served an area of 175 square miles, had not, and he conceived the idea of uniting them all

THE NEWS—*continued.*

as one body of sportsmen. That was the origin of the Guild. The motive of the Directors was not altogether an unselfish one, for anything that one did to make a man fit for his work is a sound investment.

Mr. F. J. Gorman also responded.

Mr. Terrace then distributed the prizes, after which a musical and humorous programme was provided by the "Escalators" Concert Party.

A Smoke Abatement Campaign.

The "Manchester Guardian" for Tuesday, Nov. 18, devoted a complete page to the cause of smoke abatement, when Alderman Will Melland, J.P., Chairman of the National Smoke Abatement Society, contributed an interesting and valuable article on the subject, viewing the matter from the point of view of national economy, public health, and the domestic problem.

It is, of course, impossible, stated Alderman Melland, to arrive at anything like an exact estimate of the monetary cost of smoke, but reasonable consideration of the many items involved suggest that the annual cost to the nation is in the region of £80,000,000, or about £2 per head. Commenting upon the gradual improvement which has been taking place during the past few years, the author remarked that on the domestic side the welcome increase in the use of electricity, gas, and solid smokeless fuels has been largely counterbalanced by the increase in the number of houses, nearly all of which, in spite of using smokeless mediums to some degree, possess at least one coal fire.

In Praise of Gas Coke.

On the domestic side electricity and gas are being used more and more extensively, and the developments taking place in each of these industries will undoubtedly lead to a still greater use of these mediums. Dealing with solid smokeless fuels, Alderman Melland stated that, in addition to low-temperature carbonization fuels, which are becoming easier to obtain in every part of the country, there are vastly improved grades of gas cokes, which are easily ignitable, and burn well in the open fire.

An interesting chart was given showing the hourly smoke deposit recorded by a gauge in a suburban area, being the average of readings extending over six months. From this chart the rapid rise commencing at 6 a.m. was noticeable, reaching a maximum at 11 a.m., due to the cooking of the mid-day meal. The second peak, coinciding with the cooking of the evening meal, occurred between 6 and 7 p.m. It is therefore possible, to some extent, to observe the habits of a community by measuring the smoke produced.

Supporting Alderman Melland's article were advertisements by the Manchester Gas Department and Low Temperature Carbonisation, Ltd., together with some valuable propaganda matter by the British Commercial Gas Association in furtherance to the main article's arguments in favour of extended use of gas and gas coke. With the progress of gas, it is stated, the smoke curse is waning. In London, for instance, during the last 15 years the number of gas appliances in use has more than doubled; the soot fall has been more than halved.

Penrith Gas Undertaking's Centenary.

Penrith on Monday celebrated an important centenary, for it was on Nov. 24, 1830, that the streets of the town were first lighted by gas.

The original Company—it was a private one in those days—was formed early in that year, the first general meeting being held on April 3, 1830. As a result of negotiations, it was decided to build what was the nucleus of the present up-to-date gas-works on ground at Nether End, called Friargate Close. A contract was made with Mr. J. Malam, of Knaresborough, to erect the works for £2000, and they were completed before Oct. 30, 1830.

In 1878, the Company was transferred to the old Local Board of Health for £22,000, the output of gas at that time having risen to 13 million c.ft. per annum. The property has belonged to the town ever since. The total increase in the make of gas during the past ten years has been 45 p.ct., and the average annual consumption per consumer has increased from 24,639 c.ft. to 27,668 c.ft.

It is interesting to note that during the hundred years there have been only four Managers—Messrs. M. Abbott, to 1847; E. Shaul, sen., 1847 to 1882; E. Shaul, jun., 1882 to 1927; and J. Corrigan, 1927 to present time. Mr. Geo. Wainwright (who celebrated his golden wedding also on Monday) has been Clerk to the Gas Committee since 1883.

On Monday, Nov. 24, there was an official inspection of the works, and afterwards the Chairman of the Committee (Mr. R. McVittie) entertained the members of the Council and officials at luncheon.

Notes from Scotland.

Dalkeith Gas-Works Sold.

The British Electric Traction Company, Ltd., London, have purchased the Dalkeith Gas Light Company's works and its whole undertaking. The Dalkeith Company was formed over **100 years ago.**

The shareholders number 47, and have transferred their holdings to the British Electric Traction Company at a considerable premium.

It is understood that this London Company have a controlling interest in the following other Gas Companies in Midlothian and Haddingtonshire, and in some instances have secured the whole of the shares: Aberlady and Gullane, Gorebridge, Haddington, Loanhead, Penicuik, Prestonpans, and Tranent.

Results at Dundee.

In his annual report, Mr. James Dickson, Gas Engineer and Manager to the Dundee Corporation Gas-Works, states that the quantity of gas made amounted to 1,841,744,196 c.ft. of coal and carburetted water gas, compared with 1,858,706,250 c.ft. in 1928-29—a decrease of 16,962,054 c.ft.; the gas sold, inclusive of that used on works, amounted to 1,719,511,600 c.ft., compared with 1,696,366,300 c.ft.—an increase of 23,145,300 c.ft. Gas unaccounted-for amounted to 6·6 p.ct. of the production, compared with 8·70 p.ct. during the previous year. This reduction accounts for the increased sale notwithstanding a reduction in the quantity made. The increase in gas sold, alongside keen competition with electricity, supplies ample evidence that the commodity is more than holding its own. A high yield of gas per ton of coal carbonized and equivalent—*i.e.*, 17,727 c.ft. compared with 15,928 c.ft.—was due to the increased manufacture of carburetted water gas, and to important adjustments in the steaming arrangements of the vertical retorts.

With reference to the increase of 1d. per 1000 c.ft. in the price of gas, the report states that it is hoped that this increase will enable the Undertaking definitely to dispose of the debit balance which has been shown in the Department's accounts since the year ended May 15, 1922, at which period the figure stood at £70,000.

The Colinsburgh (Fifeshire) Gas-Works are to be closed in the middle of January, instead of at the end of November, as was originally intended. The Anstruther Gas Company, owners of Colinsburgh Works, state that the consumption of gas in the district is so little that it has been decided to close down rather than incur the expense of machinery replacements necessary.

Gas Service at Christmas.

It is at Christmas more than at any other time of the year, says Rita Strauss, writing in the current issue of "A Thousand and One Uses for Gas," that one appreciates home comforts, and in the properly equipped labour-saving home comfort at its best is assured, while the extra work entailed by the Christmas festivities will be got through so smoothly that it will not perceptibly affect the normal routine. By turning on the gas tap we can have in a few seconds bright glowing fires in the guest-rooms, a luxury undreamed of by our grandmothers, who must have shivered in their cold fireless bedrooms. We can have constant hot water, too, and can cook the Christmas dinner with the greatest ease and the minimum amount of watching. At the same time we can keep the house clean, cheery, and bright because no smoky fuel is used.

Giving a dance or children's party is a much simpler matter than it was in the old days, what with gas cookers on which a whole meal can be prepared in one cooking and gas-operated refrigerators in which one can make as much ice as one needs and keep food fresh for days if required.

The spirit of Christmas is a kindly one. It moves us not only to hospitality but to the bestowing of gifts upon our friends, and among the presents most appreciated are gifts for the home. A visit to the gas undertaking's showrooms will be productive of many seasonable ideas. There's a gas lighter for smokers, for instance, which will be appreciated by both the men and women of a household. There are all kinds of pretty lampshades, too. There's a gas poker burner with which any solid fuel fire can be lighted without paper or sticks. Then there is a coffee percolator which makes consistently good coffee, to say nothing of a host of other useful and novel gadgets which cannot fail to please the most exacting friend.

The same issue of "A Thousand and One Uses for Gas" contains a number of useful recipes for Christmas fare and how to prepare them with the help of an up-to-date gas cooker.

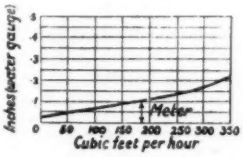
THE "PROGAS" DOMESTIC GOVERNOR.

The success of the "Progas" system dealt with in the "JOURNAL" last week is largely dependent on the design of the governor installed. "Gas Engineer" considers this matter to-day.

In an article in last week's "JOURNAL," the "Progas" system was described, which proposes a rise in district pressure up to 20 in. W.G., and the installation of governors on the inlet of every consumer's meter. It was pointed out that the success of the system was largely dependent on the design of the governors installed. These should possess certain characteristics, which are summarized below:

1. The governor shall be robust and simple in design.
2. It shall be light in weight and of small dimensions.
3. It shall be unaffected by dust and dirt in the gas, which should be removed by suitable devices.
4. It shall be automatic in its operation.
5. It shall operate accurately over a wide range of gas consumption.
6. It shall function correctly at gas pressures ranging between a normal pressure of 2 in. or 3 in. W.G. and a raised district pressure up to 20 in. W.G.
7. It shall be capable of easy adjustment, without the interruption of the gas supply to the consumer.
8. There shall be no communication between the governor and the outer atmosphere, whereby an escape of gas could occur.
9. When the gas consumption ceases, the governor shall shut off completely, without allowing the outlet pressure to build up beyond a certain limit—say, 5 or 10 tenths above the normal outlet pressure.
10. The initial cost of the governor and the cost of installation shall be low.

The above points may be common to the "Progas" governor and alike to other types of governors. The "Progas" governor, however, possesses a distinguishing feature, through which the carrying capacity of the house pipes after the governor is increased. While the ordinary pressure governor maintains a constant pressure on its outlet, the pressure at the point of consumption may vary, as a result of the loss of pressure in the services, which depends on the rate of gas consumption. The case is illustrated in fig. 1, which shows the pressure conditions in a ¾-in. service, 16¾ ft. long, at varying rates of gas consumption, when the gas pressure on the inlet to the service is constant.



Loss of Pressure through a Meter with varying Consumption

Pressure at the Governor outlet and at the appliance inlet with constant-pressure Governor and varying consumption (16½ feet ¾" piping)

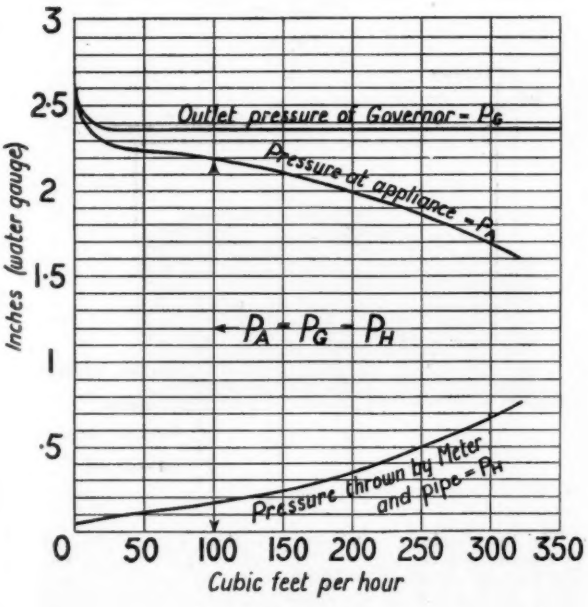
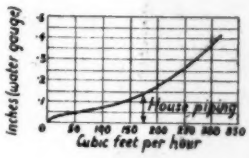

Inches (water gauge)
Outlet pressure of Governor = P_G
Pressure at appliance = P_A
$P_A = P_G - P_H$
Pressure thrown by Meter and pipe = P_H
Cubic feet per hour

Fig. 1.



Loss of Pressure through house piping, 16½ feet long ¾" piping with varying consumption

Pressure at the Governor outlet and at the appliance inlet with rising outlet pressure at varying consumption

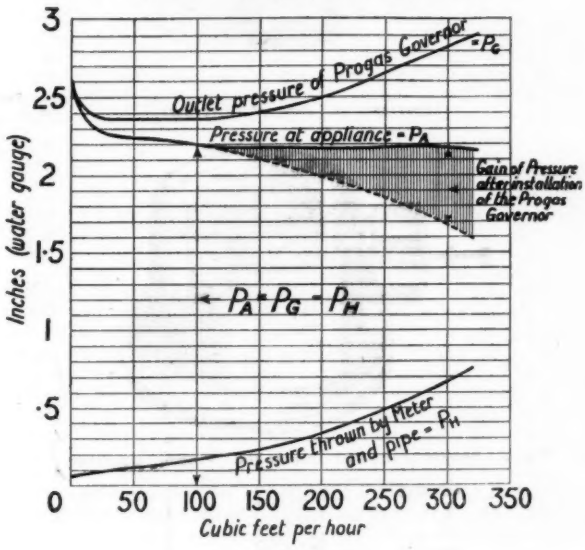

Inches (water gauge)
Outlet pressure of Progas Governor = P_G
Pressure at appliance = P_A
Gain of Pressure after installation of the Progas Governor
$P_A = P_G - P_H$
Pressure thrown by Meter and pipe = P_H
Cubic feet per hour

Fig. 2.

The "Progas" governor, on the other hand, aims at constant pressure at the point of consumption. The pressure on the immediate outlet of the governors consequently varies with the gas consumption, and thus compensates for the loss of pressure occurring in the service between the governor and the gas appliances. The pressure conditions prevailing after the installation of a "Progas" governor on the same service as that used in the first case is shown in fig. 2. The advantage to be derived from this type of governor is readily apparent, and would seem to justify a fuller description of its performance and design.

PRINCIPLE OF DESIGN AND OPERATION OF THE "PROGAS" GOVERNOR.

A cross-section of the "Progas" governor is shown in fig. 3. The gas enters through the inlet (*a*) into a large annular space (A), where it strikes a baffle plate (*z*). It then passes through two perforated plates (z_2) round the annular space (A) and finally through a gauze filter (z_1), before it enters the valve proper. As a result of the reduction in velocity, the impact with the baffle plates, and the filter, the gas is freed from foreign bodies which it may carry, so that the working parts of the valve, the valve float (*f*), and the seat (*g*) remain clean even after a long service. The details of the filtering arrangements are shown in fig. 4. Any dirt which may accumulate in the annular space (A) can be removed through the inlet opening (*a*) after disconnecting the governor from the gas meter

to whose inlet it is fitted. It thus serves for the protection of the meter against high gas pressure and also against dirt.

The governor has been designed on the differential principle, and is operated by the difference between the inlet and outlet pressure of the governor. The former is exerted on the small diaphragm (*i*), while the latter is effective on the larger diaphragm (*c*). Both are attached to the hollow valve float (*f*), through which the gas passes on its way to the outlet (*b*). The gas passage in the valve float (*f*) is conically shaped so as to cause an increase in the gas velocity. When the gas velocity is reduced again in the outlet service of the governor, the velocity head is converted into static pressure. The outlet pressure is greater by this amount than the pressure in (C) and

Appearance of "Progas" Governor.

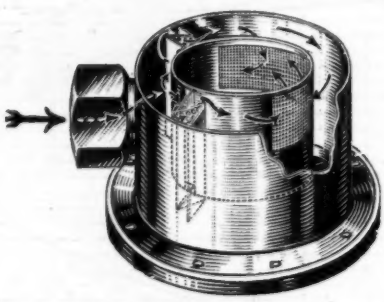


Fig. 4.—Details of the Dirt Trap in the "Progas" Governor.

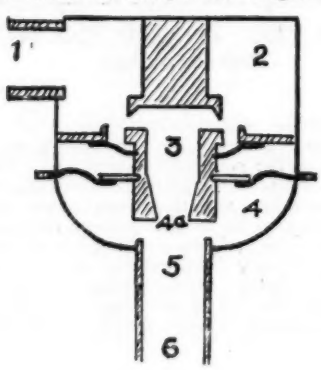


Fig. 5.

thus compensates the increase in resistance of the services caused by an increase in gas consumption. The required pressure at (C) is obtained by a simple adjustment of the valve seat (*g*), which is effected by slightly turning the valve stem by means of a key. Access to this is readily obtained by removing the cap (*k*) and turning the safety valve. The movement of the valve (*f*) is not more than 0·20 in. to 0·40 in., so that the membranes are not overstrained. When the gas is shut off, the pressure at (C) rises about 5 tenths W.G. and causes the valve (*f*) to close completely, by being pressed against (*g*). As the surface of (*f*), which comes into contact with (*g*), consists of three layers of leather impregnated with oil, the risk of damaging the seat is eliminated and gas tightness is ensured.

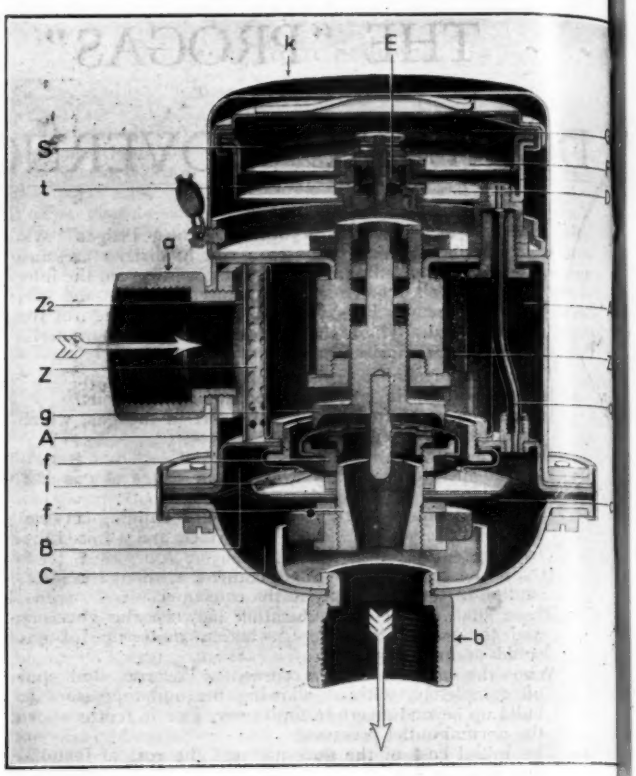


FIG. 3. Cross-Section of "Progas" Governor.

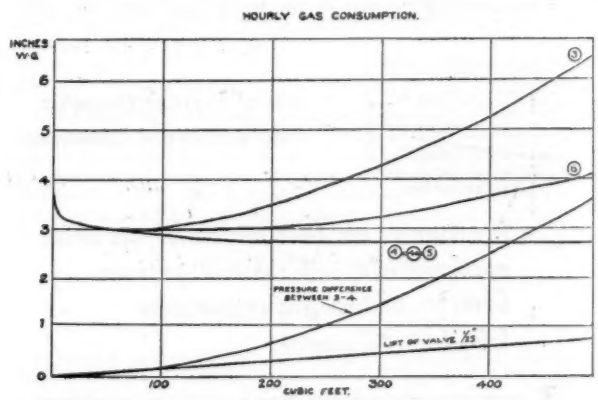


Fig. 6.

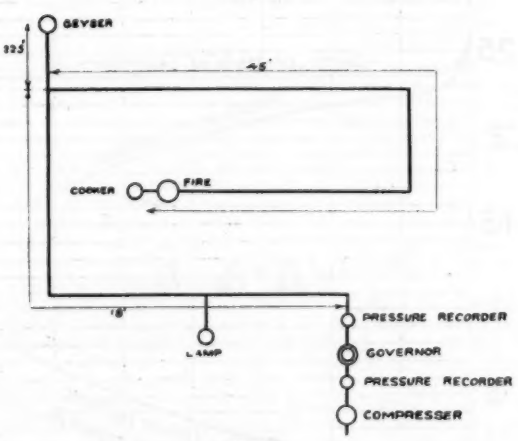


Fig. 7.

The two diaphragms (*c*) and (*i*) enclose a space (B) which is in communication with (D) through a small copper tube (*q*) and through openings in valve (*t*) with (E) and (F). The space (F) is separated from the outer atmosphere by the diaphragm (*s*), whose upper side is under atmospheric pressure present

under the loosely fitting cap (*k*) of the governor. This diaphragm, therefore, provides for the equalization of pressure in space (B) and that of the outer atmosphere. At the same time, the latter is excluded from space (B), which thus retains the same air, so that the access of fresh oxygen to the working parts of the governor, in particular to the leather diaphragms, is prevented. The design also ensures against a leakage of gas into the outer atmosphere. If one of the working diaphragms should become defective (an occurrence rarely experienced with " Progas " governors) the gas enters into space

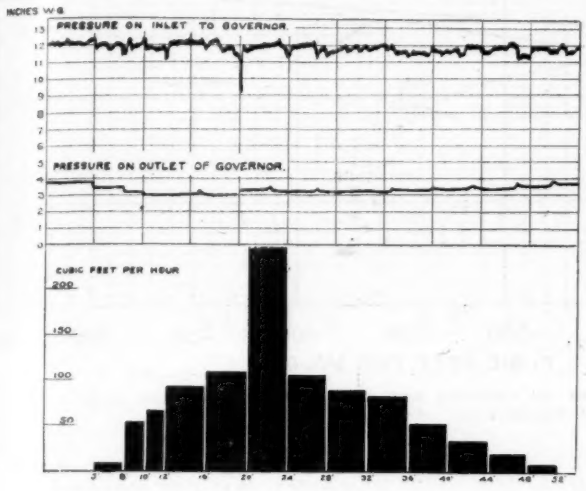


Fig. 8.

(B). The rise in pressure occurring in (B) is transferred to (D) through the communication tube (*q*) and also to (F). The diaphragm (S) will be lifted and close the safety valve (*t*), which is attached to this diaphragm, a pressure of 5 tenths W.G. being sufficient to effect the operation of the diaphragm (S).

Pressure Conditions in the Governor.

Messrs. E. Frei and C. Barckmann, Consulting Chemists of Hamburg, have examined the pressure conditions in the governor at various rates of gas consumption. The points at which pressures were determined are shown in the diagrammatic sketch of the governor, fig. 5. Test point (1) is approximately 1·2 in. from the inlet of the governor. Test point (2) is situated in the annular ring (A). Point (3) is within the valve (*f*), point (4*a*) is at its smallest cross-sectional area. Point (4) is situated in space (*c*) below the lower diaphragm. Point (5) is in the gas outlet of the governor (*b*), and point (6) in the service, about 1·2 in. below the outlet of the governor.

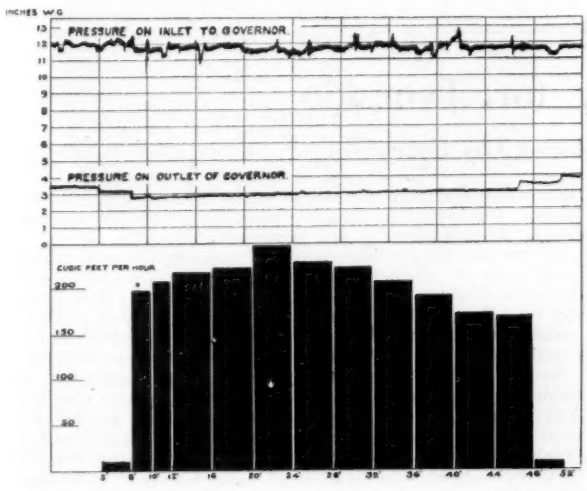


Fig. .

The results of the examination are shown in chart fig. 6. Owing to the fluctuations of the inlet pressure, which was maintained by a compressor at approximately 20 in. W.G., the pressure difference between test points (1) and (2) could not be obtained accurately, but it was observed to be of the order of 4 tenths, when the rate of consumption was 47·6 c.ft. per hour. The fluctuations were not reflected, however, on the low-pressure side of the governor. The pressures at test points (4), (4*a*), and (5) are approximately the same, and remain practically uniform at all rates of gas consumption. They are steady at 2·76 in. W.G. above a gas consumption of 70 c.ft. per hour. Below this figure, however, variations in pressure occur, as the extremely slight movement of the valve float (*f*) may allow here and there, contact between the metal seat (*g*) and the leather surface of (*f*). As the result of the design of the valve (*f*) the pressure at (6) is always higher than that at (4). As previously explained the reduction in gas velocity between (4*a*) and (6) is converted into static pressure, according to Bernouilli's theorum, which is expressed by the following formula :

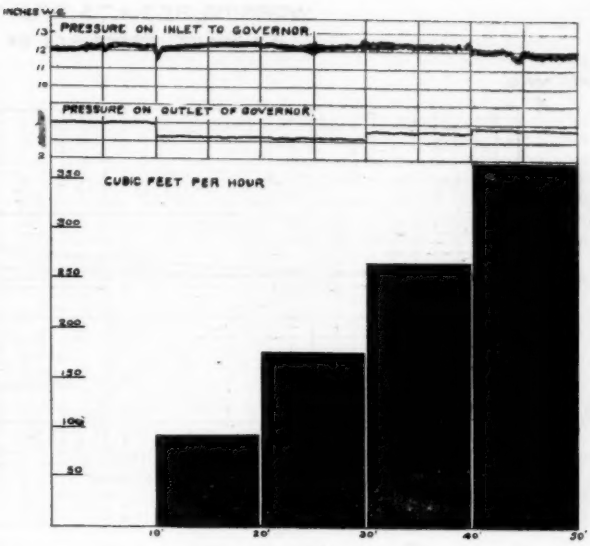


Fig. 10.

$$p_2 - pr = \frac{\gamma}{g} . V (V_1 - V_2).$$

In this formula p_2 is the pressure at point (6), pr the pressure at point (4*a*), γ the density of the gas, g the acceleration due to gravity, V_1 and V_2 the gas velocities at (4*a*) and (6) respectively. The pressure at (6) varied during the experiments from 2·75 in. to 4·14 in. W.G. and was substantially the same as the results calculated from the above formula. At first the pressure falls rapidly from zero consumption, but then slowly up to a gas consumption of 70 c.ft. per hour. The gas pressure is then fairly constant up to about 175 c.ft. per hour, to rise quickly with further increases in gas consumption. The operation of the orifice is further assisted by the pressure at test point (3) which also rises rapidly with increasing gas consumption. The experiments also indicate that the movements of valve (*f*) are practically proportional to the flow of gas, so that the gas velocity at this point remains practically constant.

A mathematical study of the forces which are operative in the governor has been made by Messrs. E. Frei and C. Barckmann, and has been published in " Das Gas- und Wasserfach,"

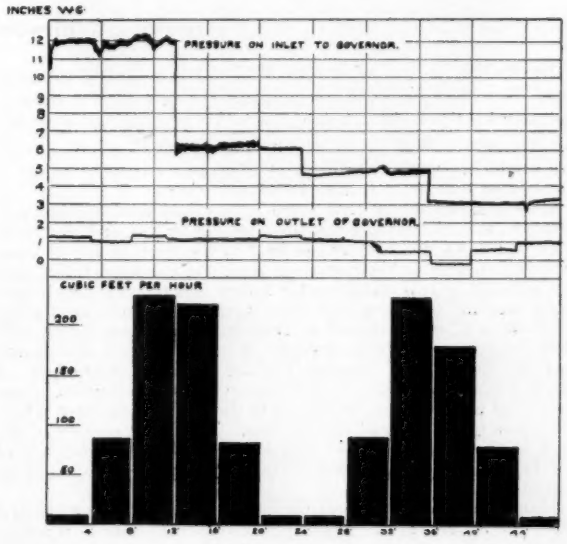


Fig. 11.

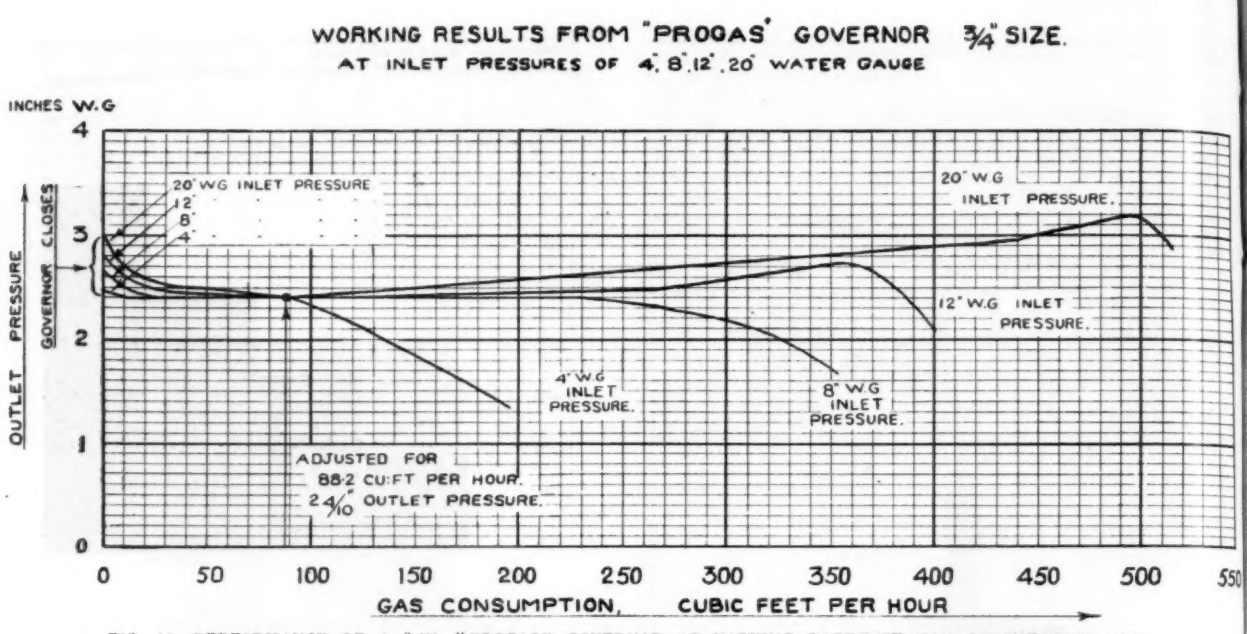


FIG. 12.—PERFORMANCE OF A ¾-IN. "PROGAS" GOVERNOR AT VARYING RATES OF GAS CONSUMPTION AND DIFFERENT INLET PRESSURES.

1930, No. 41, pp. 967-973. The analysis bears out the experimental results discussed above.

PERFORMANCE OF THE GOVERNOR IN ACTUAL PRACTICE.

Tests have also been made on the governor under practical conditions. They were carried out on three governors taken at random from stock and fitted to an improvised ¾-in. house service supplying a gas fire, a gas cooker, a geyser, and a gas lamp. The arrangement is shown in fig. 7.

The first experiment was carried out at varying rates of gas consumption at a constant inlet pressure of 11·8 in. W.G. The normal gas consumption for the governor, 88½ c.ft. per hour, was exceeded by 200 p.ct. in one case. The results are given in fig. 8, which shows the gas pressure on the inlet and on the outlet of the goveronr. The outlet pressure is practically constant at 3 in. W.G., irrespective of the gas consumption.

The second test was carried out with the same governor at constant overload. The outlet pressure was 3·14 in., and thus 0·14 in. higher than under normal load. The results are contained in fig. 9.

The third test is illustrated in fig. 10, and shows the effect of load variations with constant inlet pressure. The outlet pressure remains constant at overloads up to 200 p.ct., but rises 0·4 in. to 0·6 in. W.G., when the overload is 300 p.ct. and 400 p.ct. respectively.

It is noteworthy that, notwithstanding the pressure fluctuations on the inlet to the governor, in all three tests these fluctuations are practically wiped out in the outlet pressure.

A considerable reduction of inlet pressure has been made in test 4, fig. 11. Notwithstanding these alterations, no appreciable difference is felt on the outlet of the governor until the inlet pressure is reduced to 5·14 in. W.G. It is thus evident that there must be a minimum inlet pressure for different rates of gas consumption, which is indicated in fig. 12. When the inlet pressure is below 4 in. W.G., the governor is out of action. The governor thus will work under normal pressure conditions of the district mains, whose pressure can be raised at any time as desired. The pressure of 4 in. will suffice for the normal gas consumption of 88 c.ft. per hour, whereas 8 in. is necessary up to 230 c.ft. per hour, 12 in. W.G. for a gas consumption of 350 c.ft., but 20 in. W.G. is required for gas consumptions up to 490 c.ft. per hour, which represents an overload of over 550 p.ct. of the normal gas consumption.

Although the examination of the governor which has been described in the foregoing notes has been of a laboratory nature, the results prove sufficiently the salient points of design, the advantages of which in actual practice will be appreciated readily. On the Continent the governor has been installed in considerable numbers, and has assisted materially in overcoming distribution difficulties and in promoting the sale of gas.

A New Industry for Tyneside

Armstrong-Whitworth Making Gas Furnaces

Messrs. Sir W. G. Armstrong Whitworth & Co. (Engineers), Ltd., Newcastle-on-Tyne, recognizing the fact that in modern industry heat is a more important factor than power, and that gas has proved itself the most convenient form of potential heat, are producing at their Scotswood Works an extensive range of gas-heated industrial furnaces and appliances.

Research has shown that some 20,000 industrial heating processes in this country are already operated by gas, and that more than 60,000 specific articles use heat in the form of gas at some stage or another in their manufacture. It has been found that the demand in two instances for rotary and crucible gas-heated brass-melting furnaces has been such that mass production methods are being adopted at Scotswood for these highly efficient furnaces. In the rotary type of furnace which they manufacture, there is an unusual method of heat application. A blanket flame is produced, burning in an open chamber above the metal to be melted, instead of in the more usual form where the flame passes around the crucible. The direct contact of the heat in the former method assures the maximum efficiency of the heat units used. These furnaces are made in sizes from 200 to 1000 lbs. capacity.

Manufacturers throughout the country are realizing more and more the advantages of gas-firing by reason of ease of manipulation, speed, accuracy of temperature control, and in turn uniform output and reduced waste of product. At the Morris Motor Works, for instance, some 75 million c.ft. of gas was used during the past year for heat processes.

As the result of exhaustive tests and experiments, Messrs. Armstrong are also manufacturing crucible tilting furnaces for the melting of aluminium and aluminium alloys. New ground has been broken here insomuch as the furnace lining is of an entirely original and patented design. With the advent of mass production in the motor industry and in the manufacture of telephone and wireless components, pressure casting of aluminium has developed in a most remarkable degree. With the Armstrong Whitworth pressure casting machine, castings of a most intricate nature can be produced on mass production lines. Good examples of these are at present being shown in the Newcastle-upon-Tyne and Gateshead Gas Company's Grainger Street Showroom windows.

In keeping with recent developments in printers' machinery, the casting and refining of linotype and monotype metal has advanced in a corresponding degree. Messrs. Armstrong's new soft metal refining and igniting furnace offers the printer all he can desire in this direction. Automatic temperature control, a standard on these furnaces, avoids metal wastage, and the specially designed casting tray ensures metal of a clean and reliable nature. In manufacturing processes, the elimination of waste is an essential feature. The value of bearing-metal being

considerable, certain railway shops have adopted Messrs. Armstrong's patent chain conveyor gas heater demetalling furnace in order that the bearing-metal mass be reclaimed from their worn locomotives and carriage bearings.

Other types of furnaces being produced by Messrs. Armstrong include one for lead melting, for feeding lead presses and general lead scrap and alloy melting, of from 2 to 4 tons (lead) capacity. It has been arranged that any of Messrs. Armstrong's wide range of industrial gas furnaces can be tested by manufacturers interested at the Newcastle Gas Company's Industrial Laboratory. In this Industrial Service Laboratory there is a well equipped plant capable of dealing with any industrial heat problem. The Laboratory and the technical staff attached thereto are at the free disposal of any manufacturer for experimental or research work in any industrial sphere.

The manufacture of gas furnaces by Messrs. Sir W. G. Armstrong Whitworth & Co. is quite a new industry to Tyneside, and it is to be hoped that it will be entirely successful. New industries are certainly required on Tyneside, and in addition to assisting employment in the manufacture of gas furnaces, the use of these will also assist the cause of smoke-abatement throughout the country. So far, sixty workmen are employed in this new branch of Messrs. Armstrong-Whitworth's undertaking, and it is expected that as developments take place in the future a much larger number of men will be found employment.

EFFICIENT AND DURABLE . . . MAIN COCKS . . .

Messrs. Falk, Stadelmann, & Co., Ltd., claim for their hot-pressed main cocks advantages which are considered in this article.

A good gas cock depends primarily upon its gas-tightness, ease and efficiency of manipulation, and reliability under all working conditions. Tests carried out recently by the Industrial Research Laboratories of the Birmingham Gas Department show that Messrs. Falk, Stadelmann, & Co.'s new type of hot pressed main cocks fulfil these requirements.

For some time past hot stamping has been common practice with small gas appliance cocks, but it is claimed by the makers that this is the first time the method has been extended to main cocks for services.

Some Advantages of Hot-Pressing.

Hot-pressing is, of course, the process of forming brass to the required configuration by the exercise of high pressure on ingots of extruded metal heated to the temperature of plasticity. The metal is stated to be of a higher grade than ordinary "rodding," as used for capstan work. The actual stress on the press for the type of cock described here is no less than 90 tons, which, on articles of an average size, is equivalent to 15 to 20 tons per sq. in. It necessarily follows that the application of such high pressure on close texture metal eliminates porosity and the troubles liable to cast joints—such as searing and sand holes.

The walls of the body of the cock produced by the hot pressing method do not vary in thickness, which may be caused by misplaced core stocks in the case of cast cocks—a contingency resulting in weakness which is not readily apparent, but which manifests itself on installation. The plugs of the hot-pressed cocks are solid, preventing trouble from naphthalene accumulation, are washer-nited, fitted with hexagon nuts, and, on account of the quality of the metal, do not require re-grinding, which is often such a source of considerable expense to many gas undertakings.

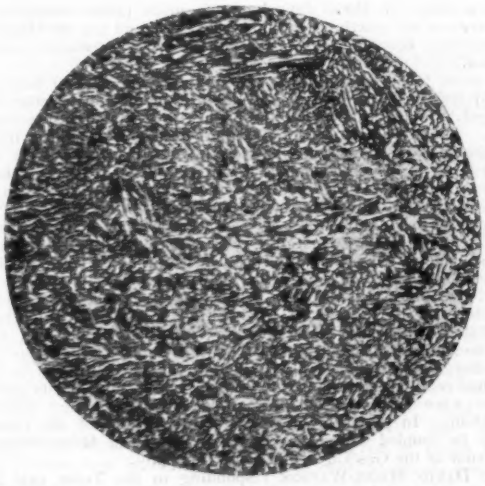
The seating or grinding-in is perfectly smooth, because, claim the makers, a finer mixture is used for the purpose than can be employed for cast plugs. This results in a silky operation devoid of the least suggestion of harshness. The "shut-off" is sufficient to secure absolute safety.

Messrs. Falk, Stadelmann, & Co., have put down special machinery and very expensive tools for the production of these gas cocks in sizes ranging from ⅜ in. to 1 in., and we understand that several gas undertakings are using them. Every fitting is tested by the firm up to 10 lbs. per sq. in. air pressure under water, and guaranteed sound when supplied, all threads being gauged before dispatch.

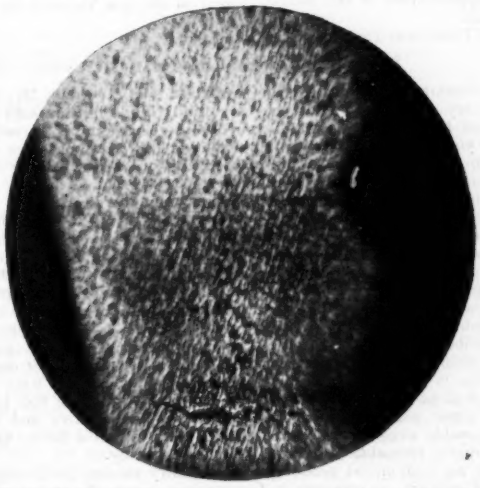
The Brinell Test.

In regard to this test, the Industrial Research Laboratories of the City of Birmingham Gas Department stated that the hot stamping tested was made from a brass containing about 60 p.ct. of copper. The section was perfectly sound, no holes or flaws being visible at any point. The grain size was very small and uniform; the material is harder than the cast brass, and should machine to a smooth surface more readily, enabling a ground joint to be made more accurately and to last longer in service. From the point of view of the user, state the Laboratories, the brass stamping has the advantage over a sand cast cock of similar type of better external finish, harder wearing surfaces, and freedom from blowholes or segregations, which produce porosity.

The accompanying photographs show magnifications of longitudinal sections through hot-pressed gas cocks, indicating the very close, uniform grain, free from flaws, blowholes, and "spilley" metal or segregation of any kind.



Longitudinal Section Through Gas Cock from Hot Stamping. Magnified 100 Times.



Longitudinal Section Through Gas Cock from Hot Brass Stamping. Magnified 25 Times.

Society of British Gas Industries

MR. FRANK WEST ON REFRACTORIES

The Autumn General Meeting of the Society of British Gas Industries was held at the Hotel Metropole, London, on Wednesday, Nov. 19—the Right Hon. Lord EUSTACE PERCY, M.P. (President), in the chair.

The Meeting was preceded by a luncheon, at which the President was also in the chair.

Luncheon Speeches.

After the Toast of "The King" had been honoured,

Mr. FRANK WEST (Chairman of the Council) proposed "The President," and reminded those present that through unforeseen circumstances it was impossible for Lord Eustace Percy to be present at the annual meeting in May, when, in accordance with custom, he should have been invested with the chain of office. This, therefore, was the first opportunity they had had to offer Lord Eustace Percy a very cordial welcome to the Society, and an expression of their good wishes as President. They were all honoured by Lord Eustace Percy's acceptance of this office; and everybody wished him a thoroughly enjoyable year as President. Lord Eustace Percy already had had a distinguished career, and the services he had rendered to his country both in diplomacy and in politics were matters of public knowledge. He had filled important Ministerial positions as Parliamentary Secretary to the Board of Education and to the Ministry of Health, and, later, as President of the Board of Education; and they all looked forward to him holding more important positions when his party returned to power. Their new President had also, said Mr. West, already come into contact with the gas industry, because it would be remembered that he delivered an excellent Address before the British Commercial Gas Association last autumn on the subject of Education for Commerce and Industry. The members of the Society of British Gas Industries all hoped that Lord Percy's association with them would enable him better to visualize all their problems, so that, when occasion arose, the interest which these problems would excite in his mind, and the greater knowledge he would obtain of the circumstances under which this branch of the gas industry fulfilled its functions, would both incline him to support the cause of the gas industry in Parliament and enable him to do so with increased insight into the importance and significance of that great industry. Before formally submitting the Toast, Mr. West apologized to the President for the absence from the meeting of his brother, Alderman F. J. West, who was instrumental in persuading Lord Eustace Percy to consent to occupy the office of President of the Society. His brother, who was abroad at the present time, had asked him, said Mr. West, to convey his good wishes and keen appreciation of the interest taken in the gas industry by Lord Eustace.

The Toast was carried with enthusiasm.

A Policy of Economy.

The PRESIDENT, acknowledging the Toast, said: I thank Mr. Frank West very much indeed for the very kind things he has said about me, and I also have to thank you on this occasion, as I could not thank you before, for conferring upon me the chain of office which I did not have a chance either of receiving or acknowledging on the previous occasion. I want to assure you how great an honour I feel it is that you should have asked me to take the Presidential Chair this year, and I am quite sure that Mr. West is right when he says that in the future when the gas industry has questions which it wishes to bring before Parliament I shall be a wiser if not a happier man from my association with you. I have been wondering how I, as a poor politician, could show to you to-day the appreciation of the honour you have conferred upon me, and I have come to the conclusion that the only way in which I can do it is to try to make a contribution as a politician to the main question which I am sure every member of this Society is thinking about at the present moment, and that is what Government economy may mean. We have had a great deal of talk about economy, but I think the time has perhaps come when some politician might make some tentative and wholly irresponsible suggestions as to the lines upon which a future Government might formulate a definite policy of economy.

Just as economical production in industry means the re-organization of industry, so economy in Government means the re-organization of Government. The real vice of our Government is not administrative extravagance, but over-trading. The only cure for that vice, in Government or in business, is to cut down responsibilities. What are the unescapable responsibilities of the central Government? First, the national debt. The service of that debt may be regarded as absorbing the whole yield of estate duties and surtax and about seven-eighths of the yield of income-tax (taking income-tax and surtax at the rates in force from 1925 to 1929), together with foreign debt payments. Secondly, what may be called the security services—defence, police, and justice. Thirdly, foreign and colonial services. Fourthly, pensions directly payable by the central Government to its old servants and old age pensions payable under the original non-contributory Act of 1908. Fifthly, the collection of the national revenue. Sixthly, so long as local authorities derive their revenues mainly from taxes on the rental value of land and buildings, the central Government must equalize the burden of taxation, both as between different local areas and as between individuals in each local area, by making to local revenues a contribution from national taxes levied on personal property or consumption. This is the true nature of grants to local authorities. They are grants in relief of the ratepayer, not grants in aid of particular local services.

Unescapable Responsibilities.

These unescapable responsibilities accounted in the period 1925-29 for some ten-elevenths of all the expenditure of the central Government, outside the self-supporting business of the Post Office. They also, roughly speaking, just about absorbed, or rather more than absorbed, the whole tax revenue of that Government, except the motor vehicle duties assigned to the Road Fund, together with foreign debt payments. Yet, expensive as these unescapable responsibilities are, how profound would be the simplification of our whole national economy if the executive and Parliament could concentrate attention upon them to the exclusion of all other distractions! But, if they did so, how should they regard the other existing activities of Government, especially the "social services?" It may be suggested that the answer is to be found in two broad principles.

The first is this: The community as a whole is responsible for the child and the unfit, and also for public health services such as sanitation and the control of infectious disease; but the responsibility for the worker employed in industry in all its forms should fall on industry itself. Education, child-welfare, and the relief of destitution are proper State services; health insurance, workmen's compensation, unemployment insurance (so far as it covers the legitimate insurance risk of temporary unemployment), and pensions for widows, orphans, and the aged (so far as these are payable to the retired servants of industry or to their families) are industrial services which should be managed by the contributors to these insurance funds, and in which the State should act only as the agent of industry for the collection of contributions. It follows that unemployment insurance should be put on a rigidly actuarial basis with greatly reduced contributions, and that the State should take over from the unemployment insurance fund responsibility for all those who must be regarded as permanently unemployed.

The second broad principle is that, under this division of labour between the State and industry, the responsibilities falling on the State should be discharged, not by the central Government, but by the local authorities. The only supervisory functions which the central Government ought to exercise over local authorities are first, ascertainment and certification to Parliament that local authorities are complying with the law, and, secondly, control over borrowing by local authorities. Attempts by the Government to control the current revenue expenditure of local authorities are almost invariably ineffective; the only sure way to local economy is to make local administrators masters in their own house.

Two Main Tasks.

Government in these days has two main tasks—economical administration of strictly Government services and the development of the nation's economic resources—agricultural, industrial, and commercial.

In order to devote itself to these purposes the central Government should strip itself of distracting liabilities which can better be discharged by industry, by local authorities, or by public utility organizations. Social reform will not suffer by being excluded from the calculations of the Chancellor of the Exchequer in each annual Budget, or by being exempted from roving debates in Parliament, which commonly neither conduce to economy nor throw any light on social policy. It will thrive far better in the hands of really responsible local authorities, advised by such non-political bodies as the "real Board of Education," which the educationist has so often and so rightly advocated, and which I am quite sure Sir Francis Goodenough has often sighed for in his experience of education.

Mr. D. MACCALLUM GIBB, proposing the Toast of "The Past-Presidents of the Society of British Gas Industries," said that ever since the formation of the Society 25 years ago many very eminent men had passed through the Presidential Chair. Some were present that day, but there were a few who would have liked to be present and had really intended to come, but had been unavoidably prevented. These were Lord Riddell, Sir Robert Hadfield, and Sir Arthur Duckham. In proposing the Toast of the health of the Past-Presidents, he coupled with it the name of Sir David Milne-Watson, the Governor of the Gas Light and Coke Company.

Sir DAVID MILNE-WATSON responding to the Toast said he had always regarded it as one of the greatest honours of his business career to have acted as President of the Society, and he looked back with extreme interest to his year of office. He had listened with the greatest interest to the remarks of Lord Eustace Percy, and felt that he had never heard a more clear statement of the functions of the State with regard to economy than that. He hoped that full publicity would be given to it, because it was a most illuminating statement, and he sincerely trusted that what had been said would not fall on deaf ears, as the gas industry was most interested in what Lord Eustace Percy had adumbrated. The industry was a controlled industry, controlled by the State, not actually in its daily operations, but by the rules and regulations under which it had to operate; and therefore it had a right to look to Parliament to make it easier for the industry to obtain alterations and amendments promptly and efficiently to the legislation under which it existed. For years and years those concerned with the management of the industry had been pleading for gas legislation to be brought up to date, and the answer always was "There is no time." There was no time to be found for taking this question up and passing the necessary legislation, and anything that would facilitate that and

help in economy of Parliamentary time so that Parliament could find time to pass the necessary legislation, in connection with those industries which it had taken under its wing, would be of very great advantage to the gas industry.

BUSINESS MEETING.

The CHAIRMAN read the report for the past year as follows:

Report of the Chairman of the Council.

The following is a short report of the work for the past six months.

In the first place, we have to record with sincere regret the passing away of one of our distinguished Past-Presidents, Prof. Harold B. Dixon, who occupied the Chair in 1913-14.

We also have to record with regret the death of the following members: George A. Sugg (Director, William Sugg & Co., Ltd.), Samuel Glover (Director, West's Gas Improvement Co., Ltd.), and C. Ernest Wilson (Director, Wilsons & Mathiesons, Ltd.).

Our congratulations are offered to Dr. E. W. Smith on the conferment on him by His Majesty the King of a Commander of the Order of the British Empire for his services as Technical Director to the Area Gas Supply Committee.

We are indeed indebted to the Right Hon. Viscount Cecil of Chelwood, our Past-President, for the admirable address he presented to the Society in May, in which he dealt with Industrial Relationship. This address was full of valuable suggestions and very interesting to all our Members, and we sincerely thank him for the address and the time he has devoted to the interest of our Association during his Presidency.

BOARD OF TRADE COMMITTEE ON DEATHS FROM GAS POISONING.

We are co-operating with the National Gas Council on this matter.

JOINT COMMITTEE ON GAS HEATING.

We are represented on the Joint Committee set up by the British Commercial Gas Association and the Institution of Gas Engineers.

BRITISH INDUSTRIES FAIR, BIRMINGHAM, 1931.

We are again organizing a Gas Industries Section at the Fair for next year, and the other bodies in the Gas Industry are co-operating with us. Arrangements are now well in hand and nearly all the space available has been allotted.

A Joint Gas Conference is again being arranged to be held during the Fair when important Addresses will be delivered by leaders in the industry.

INTERNATIONAL ILLUMINATION CONGRESS, 1931.

We have appointed two representatives on the Finance Committee in connection with the Congress and are giving our support.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The Sub-Committee of the Illumination in Industry Committee, upon which the Society is represented, have prepared the British Standard Classification of Symmetrical Light Distributions and Lighting Fittings which has now been approved and published.

FEDERATION OF BRITISH INDUSTRIES.

We have been represented on the Sub-Committee on Restraint of Trade and the Consumers' Council Bill.

CITY AND GUILDS OF LONDON INSTITUTE.

The Prizes in the City and Guilds of London Institute in the recent examinations in Gas-Works Practice, Gas Supply Practice, and Gas Fitting have been duly awarded and announced in the Technical Press.

GAS SALESMEN'S CIRCLES.

Last year we offered a Gold Medal to be awarded annually for the best Technical Paper in the Gas Salesmen's Circles. The Papers submitted for the session 1929-30 have been adjudicated and the Society's Gold Medal has been awarded to Mr. Joseph E. White for his paper on "Gas and the Modern Engineer," and we offer him our hearty congratulations.

At the conclusion of the report, Mr. West drew attention to the British Industries Fair next year, and expressed the hope that all the members of the Society would do their best to support the programme. The Joint Committee had arranged the following programme: Feb. 19, meetings of Junior Gas Associations; Feb. 20, Gas Salesmen's Conference; Feb. 24, Society of British Gas Industries; Feb. 25, Institution of Gas Engineers; Feb. 26, British Commercial Gas Association. Sir Arthur Duckham had been elected President for the Conference, and on Feb. 24 there would be a Presidential Address. This was the first time a Presidential Address had been delivered at these Conferences. Mr. West also mentioned that the President (Lord Eustace Percy) had promised to attend a lunch during the Conference.

Mr. D. M. GIBB, in seconding, expressed congratulations to Dr. E. W. Smith on the honour recently conferred upon him by the King.

The report was unanimously adopted.

The CHAIRMAN then presented the Society's Gold Medal to Mr. Joseph E. White for his paper on "Gas and the Modern Engineer," and congratulated him on being the first recipient.

The Activities of the Society of British Gas Industries, with Special Reference to Refractories

Address by FRANK WEST, M.I.Mech.E., of Buxton, Chairman of the Council.

The Society of British Gas Industries is now in its twenty-fifth year. Looking back over that quarter-of-a-century it can be fairly claimed that the Society has fully realized the aspirations of its founders. It was built upon a sound foundation; it has stood the test of time; and to-day we can feel that it is in a distinctly healthy condition.

Its main object was that of co-operation with other organizations for the benefit of the gas industry. The record of the Society shows that its co-operation has been wholehearted, effective in proportion to its importance, and at most always successful. The Society has "pulled its weight" and gone forward with one voice with its declared policies. But, while we may look back with a considerable degree of pride upon past achievements, it cannot be concealed that much remains to be done.

In the first place, it cannot be said that there is anything like sufficient co-ordination between the several organizations within the gas industry. It has more than once been pointed out that the present system of three or four more or less independent organizations, largely attended by the same people and often dealing with the same subjects, leads to a considerable waste of time and effort, as well as to dissipation of energy and money. We still look with envy on the great American Gas Association which brings together all sections of the industry, technical and commercial, sales and manufacture, into one vast convention, in which all members, whatever their function in the industry, meet and exchange views while doing their business in sectional committees without overlapping.

We hope the time is not far distant when the activities not only of this Society, but of the Institution of Gas Engineers, the National Gas Council, the British Commercial Gas Association, and other bodies, will be organized into one all-embracing convention, in which all will meet to deal with their common problems and to speak with a united voice in the common interest.

Several Addresses have been given from time to time by the Chairmen of the Council, dealing with the activities of the Society, the last being that of Mr. Tilley in 1923; and I do not intend to do any more than indicate the main lines into which our energies have been directed, leaving to the appendix a summary of the more important measures and operations carried through by the Society.

As regards publicity, the Society itself was formed at the Earl's Court Gas Exhibition in 1905, which may be said to be the first step taken by the gas industry in modern methods of publicity. In 1907 we assisted in the Gas Exhibition in Manchester. In 1911 we co-operated with the Institution of Gas Engineers in the formation of the British Commercial Gas Association, now one of the most live bodies in the industry. We assisted in 1913 at the Gas Congress and Exhibition at the White City, London, and in 1924 and 1925 we took our full share of the organization and carrying out of the magnificent exhibit of the gas industry at the British Empire Exhibition at Wembley. In 1928 we took part in the first World Power Conference, and did much to give full weight to gas in the Fuel Section of that Conference. And we have been splendidly represented at the British Industries Fairs of 1929 and 1930.

Our work in the educational and scientific field has included a generous contribution to the establishment of the Livesey Professorship of Coal Gas and Fuel Industries at the Leeds University, and participation in 1911 with the Manchester District Institution in a scheme for the education of gasfitters. In 1917, and again in 1929, we co-operated with Government Committees in the preparation of reports on the conservation of coal and on the prevention of accidents in connection with repairs to gasholders, respectively. And in 1920 and 1921 we contributed

joint papers to the Proceedings of the Institution of Gas Engineers on Carbonization, Tar Distillation, and the Treatment of Ammonia.

We have done a great deal in the work of standardization, beginning with the drawing up with the Institution of Gas Engineers of an agreed Standard Conditions of Contract in 1906, with revisions in 1909 and 1917. From 1908 to 1925 we participated fully and freely in the drawing up of the standard specifications of refractory materials, and we have done similar work in connection with gas meters, gas valve flanges, wrought-iron tubing, gas apparatus for kitchens and restaurants, and street lighting; and we did valuable work in connection with the revision of the railway classification of goods.

Our agreement with Labour organizations, particularly the Operative Bricklayers Society and the Amalgamated Union of Building Trade Workers, have been of great service to the gas industry generally.

In the organization of the industry itself we did good service in the formation of the National Gas Council in 1916. And we co-operated in 1919 with the British Commercial Gas Association in the consideration of Government housing schemes, and with the work of the National Illumination Committee in 1928.

In the future we must pay more attention yet to the scientific side of the industry and we must be prepared to spend more time and money in research work both on our own account and in co-operation with other bodies in the industry.

It cannot be too fully realized that to-day industries are judged and appraised by the Government and the public very largely on their record in research. No industry can expect to be held in the highest public esteem which is not doing its best to make the most of the resources at its disposal. I should like particularly to draw your attention to the work of the British Commercial Gas Association in advertising and bringing to the notice of the public the great place which is filled, and must continue to be filled, by gas in the domestic amenities and industrial processes of the community. This is a work which vitally concerns us all. If once the idea is allowed to gain ground that gas is out of date, that it is failing to offer the best medium for the scientific utilization of coal and the best and most economical methods of heating, cooking, and the many heating processes in the industry generally, and that it is being, or ought to be, superseded by electricity—if any of these ideas become common currency—I say that our interests as manufacturers of apparatus for use in the manufacture, storage, and distribution of gas will be fatally injured. Indeed, if the prestige of gas is at all prejudicially affected in the eyes of the public by the propaganda of its competitors, our interests are affected in exactly the same proportion.

It is, therefore, very clearly in our interest to support the British Commercial Gas Association to the full extent of our capabilities; and while we do, as a Society, give a certain amount of support in this direction, it is my considered opinion that we ought to do much more. Some members subscribe liberally, but it cannot be concealed that some members do not subscribe at all, while others do not subscribe in proportion to the importance of the work which is being done on their behalf. And I put it to those non-subscribers that it is distinctly and directly to their own advantage to subscribe as much as they can to this, the first line of defence of the gas industry.

I conclude this section of my Address as I began. The Society is in a very healthy condition. Most of its members take a keen interest in its work, and, as regards the future, I look confidently to a great increase in our activities, more cordial and generous support from our members, and a keener and more general interest in the fortunes of the gas industry as a whole.

I now turn to the subject in which I am especially interested, the subject of the refractory materials used in the furnaces and settings of the carbonization plant for the manufacture of gas, and in furnaces for the industrial utilization of gas and other allied purposes.

Refractories.

My main idea in introducing this subject is to call attention to the vital importance of refractories to the gas industry. Very little has been contributed on this important matter to the Society, although there was an excellent paper given by Mr. Pearson Perry in 1912, when he was Chairman of the Fireclay Section.

Refractories are used in most industries where any heat treatment is required. In fact, they may be said to be the barometer of the trade of the country. In the gas industry, to which most of us are allied, they play a very important part. Almost all Sections of the Society have some interest in them, either in their speciality or as users in their works. Other large consumers are the iron and steel, glass, and pottery industries, and many others in smaller degree, too numerous to mention.

In the gas industry refractories are used not only in the retort house, but by the consumer in the form of apparatus for heating and lighting. In the gas-works the whole of the retort settings are built with refractory materials, and it is very important that the right kinds of refractories shall be used in the different parts of the settings.

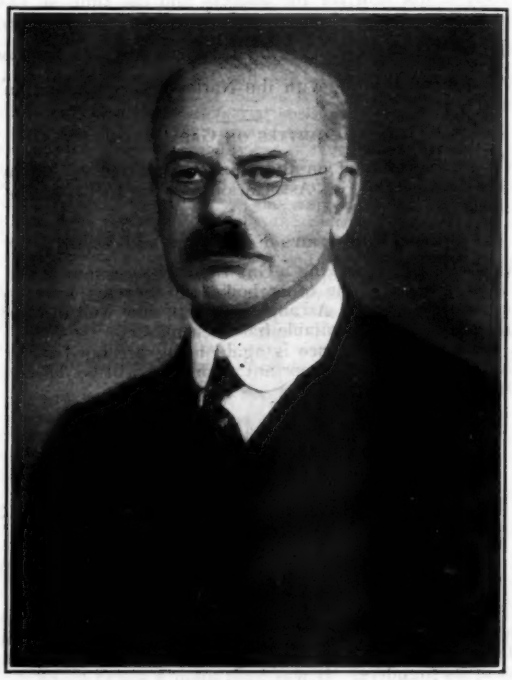
The early history of refractories is very fascinating to the delver in antiquity. One is able to trace examples of the use of refractories in ancient days B.C., and follow its progress through the ages, keeping step with the development of the ceramic and metallurgical industries, to the present day.

It is said, by some authorities, that the fireclay industry is even older than the glass industry; but, although there are records of firebrick works in the fifteenth and sixteenth centuries, it was not until the eighteenth and nineteenth centuries that refractory materials were developed on anything like a large scale.

I do not intend to take up your time with this ancient history, but I would like to deal briefly with the early history of refractories employed in the gas industry, although there is very little published data to draw on. It is probable that clay retorts were first manufactured in Scotland round about 1816 and 1820, although refractories for furnaces, &c., date back to much earlier times, as already mentioned. One may refer to the years 1850 and 1851, when there was a very lengthy discussion in the "Journal of Gas Lighting" on "Clay *versus* Iron Retorts."

It is also interesting to note the familiar names of Glenboig, Gibbons, Oughtibridge, Welsh Dinas, and Ewell, as far back as 1878; all of the concerns associated with these names are going to-day and are still of great importance to the industry, the majority being members of our Society.

The manufacture of silica bricks originated in this country early in the nineteenth century, and the first silica gas retorts were produced about 1880, and were, I understand, put in at Manchester, while some were erected at Fleetwood in 1887.



THE CHAIRMAN.

Frank West, M.I.Mech.E.

Connected from his youth upwards with the manufacture of coal gas, Mr. West commenced his training by an apprenticeship to engineering with West's Gas Improvement Company, Ltd. Following this he served articles as Gas Engineer with Mr. W. R. Chester, then Gas Engineer to the Nottingham Corporation, and remained there until he attained the position of Chief Chemist. In the year 1897 he returned to West's, and for some years was engaged in superintending the erection of large gas plants in this country and abroad, acting, later, as the Company's chief London Representative. For many years he has been connected with the Derbyshire Silica Firebrick Company, Ltd., having been Director since its inception. He took active control as Managing Director some years ago, and on the death of his father, Mr. John West, in 1922, he was appointed to the Chairmanship of the Company. He is a Past-President of the Ceramic Society, President of the Refractories Association, and a Member of the Institution of Mechanical Engineers.

In the early days, as previously mentioned, iron retorts were in use, but when the heats were increased it was necessary to use fireclay to withstand the higher temperatures. Since then the temperatures of retorts have been increased, from time to time, according to the improved designs of carbonizing plant, until we come to the present time with its very efficient gas-making plant at high temperatures, in which silica plays an important part.

The average yield of gas, with iron retorts, was given as

8300 c.ft. and with clay, in about 1890, as 10,000 to 10,500 c.ft. per ton of coal carbonized, while the present time almost double this amount is obtained, generally in silica retorts. The advance in the efficiency of carbonizing processes is so rapid that, in many cases, retort plants are to-day producing double the amount of gas on the same area as in 1913.

According to the report of the Refractory Materials Committee of the Institution of Gas Engineers, collected from a number of gas-works in 1910, the average life of retorts was given as 1257 days; but in recent published statements, such as those given in Mr. Hay's paper on Beckton experience in 1927, the life of silica retorts is given in the neighbourhood of 2000 days, working with increased temperatures and larger output of gas. These improvements with retort settings, with increased temperatures, could not have taken place if those responsible for the manufacture of refractories had not improved the quality of the materials to meet the higher duty expected of them; and great credit is due to those manufacturers, as well as to designers, for the rapid progress and great efficiency achieved on these lines during recent years in carbonizing plants.

At one time there was, in many cases, a tendency to purchase goods at the lowest price, irrespective of the quality and the duty they had to perform, but now I venture to say that the user requires something special for his money, and, moreover, he is able to ***obtain it in this country.*** In the manufacture of refractories for the gas industry, it can be confidently stated that this country is second to none.

It is noteworthy that during the period of improvement the status of the manufacturer of refractories has very materially increased, and the user, while probing into the difficulties that arise, from time to time, has begun to realize that refractories require intelligence in their making up, and that brain, as well as brawn, is required in their manufacture.

The technique of the manufacturer of refractory materials is progressing steadily and surely, and the importance of homogeneity, texture, and final constitution to their behaviour in industry has led to scientific control of manufacturing processes from the selection of the raw material to the cooling of the goods after firing. The influence of texture on the transmission of heat in firebricks and silica bricks has proved to be of the greatest importance, as also has its influence on resistance to corrosion and erosion and on general structural stability.

To the uninitiated, brickmaking is a very ordinary process, and brickworks are a blot on the landscape. It may have been so thirty years or more ago, but to-day the majority of the progressive firms have up-to-date plants and run them on scientific lines. They employ trained technicians able to carry out all manner of tests, both routine and special, while, at the same time, they are constantly experimenting with materials and grading with a view to producing improved materials. A moderate sized refractory works will spend £2000 to £3000 per year on investigation work alone.

Users also are exhibiting a keen scientific interest in the refractories they purchase. Many of the gas-works are fitted up with appliances for testing refractories, and have in their employ competent men who are able to test and prove materials offered to them by the manufacturer.

Much progress has been made, particularly in the last fifteen years, in the study of refractories on the technical and scientific side, and the manufacturer is pooling his knowledge with his fellows through various Associations connected with the industry, such as the Ceramic Society, the Refractories Association, and, in research, through the British Refractories Research Association and the joint researches carried out under the auspices of the Institution of Gas Engineers.

A large amount of work has been, and is being, done at Stoke and Sheffield in the study of various problems, from both the manufacturers' and the users' points of view. Particularly from the users' viewpoint the various papers on carbonization contributed to the Institution of Gas Engineers and other gas engineering associations are all helping to increase the fundamental knowledge of this very complicated subject.

Although immense progress has been made in recent years in the technology of refractory materials, there is, however, much more scientific work to be done on the study of the industrial use of refractories; and I can touch only briefly on some of the important phases which urgently require investigation.

It is of vital importance that accurate knowledge should be available of all conditions existent both in the retort and in the combustion chamber. This question of the definition of actual working conditions is one which invites immediate attention on the part of both makers and users of refractories. Laboratory and other tests give indications in a general way, but the greatest advance will be made by the close co-operation of manufacturer and user in recording the behaviour of certain structures during operation, and by close examination by representatives of both parties at convenient times during the whole life of the structure. Then all the data obtainable should be correlated and deductions made. By such co-operation the designer is assisted in his search for economies and the manufacturer is guided to further improvements in his products.

The output of refractories in Great Britain, according to the census taken in 1924, is given below. There is another census in course of preparation at the present time.

Products, 1924.	Quantities.	Selling Value.
		£
Refractory goods—		
Fireclay sold	385,300 tons	309,000
Silica stone sold	175,000 ,,	165,000
Bricks—		
Firebricks up to and including bricks of 9 in. by 4½ in. by 3 in.	804,600 tons	1,333,000
Firebricks or lumps, including quarries, tiles, and bricks, exceeding 9 in. by 4½ in. by 3 in.	236,100 ,,	760,000
Silica bricks up to and including bricks of 9 in. by 4½ in. by 3 in.	164,600 ,,	496,000
Silica bricks or lumps, including quarries, tiles, and bricks, exceeding 9 in. by 4½ in. by 3 in.	64,100 ,,	309,000
Total—firebricks and silica bricks	1,269,400 tons	2,898,000
Fireclay retorts	191,800 ft.	95,000
Other sorts	37,000 tons	144,000
Total value—refractory goods	..	£3,611,000

Of the above, it is estimated that the gas industry absorbs goods of the approximate value of £1,000,000 per annum. These figures show that the refractories industry is now one of real national importance.

Standardization.

The subject of standardization of refractory shapes has been brought before many of our technical associations, from time to time, but up to the present practically nothing has been done. The question has been ventilated more than once in other countries, but the position seems to be much the same as in Great Britain. In America the manufacturers of refractories have given much attention to standardization, and have produced statistics which show how rapidly production costs mount with increase in complexity of design, apart altogether from the cost of moulds. It is obviously desirable that the number of these complex shapes should be kept at a minimum.

Standardization of refractories is a very important subject, but it is a somewhat difficult one to deal with, full of all kinds of complications. The manufacturer of refractory materials is at a disadvantage as compared with many other manufacturers in that he has no absolutely uniform raw material. His products are not so much standardized by chemical composition as judged by their physical properties and performance. It is necessary to take care of the shrinkage in one case and the expansion in the other, and consequently he must take the particular material at his disposal, and, by mixing, manipulation, and modifying his process, adapt it for good service.

Designers of furnaces and retort settings are constantly improving their designs of plant for greater efficiency—and rightly so, if progress is to be made—but in such designs, often enough, too little consideration is given to the sizes and shapes of the special refractory blocks. When one realizes the enormous number of moulds each manufacturer has to make, the cost of which must be passed on to the buyer, one sees the advantage of keeping, as much as possible, to standard sizes. In many cases, in a new design of retort settings or furnaces, a complete set of new shapes is designed, which might not be necessary if more attention were given to the existing shapes, using them again wherever possible.

The draughtsman, setting out a large block with complicated channels and holes, and sometimes absence of square sides, does not always realize, as he should, the difficulty of moulding this design into a refractory shape. There is not only the cost of the moulds, but in the making there is a large wastage due to cracking in drying and burning, which necessitates making many spares, and also the long time required for the manufacture, whereas nine times out of ten, if this particular block was split up into smaller blocks, most of these difficulties would disappear, the cost of the manufacture would be reduced, and better burnt products would be obtained. A decided improvement has been made in these matters during recent years, but much more is required to be done in the future.

Standardization of shapes, &c., would encourage the brick manufacturer to carry stocks and so speed up delivery. At present it is hazardous to make stocks of special shapes, because of the possibility of changes in dimensions, &c., following modifications in the design of the retort, oven, or furnace.

With the great variety of shapes in use at present, there are obvious difficulties in introducing standardization, but there seems to be no real reason why all new plant should not be designed on a basis of standard shapes and sizes. The difficulties in standardization would become gradually less as existing plant became obsolete and was replaced or reconstructed.

There are many shapes in use in different installations which are so nearly alike that there should be no difficulty in com-

promising on one of them which could be made a standard. In some cases the difference between shapes is so slight that it almost appears to be a difference for the mere sake of difference, and not because any useful purpose is served—and yet such differences necessitate the making of special moulds. It might even be possible to secure international standardization in the more widely used types of brick and block.

Collaboration between the engineer and the brick manufacturer in the selection of standardized shapes would ensure adequate attention being given to the characteristics of the brick-making material and the avoidance of shapes and sizes which are, for any particular material, undesirable.

The gas industry pioneered the provision of specifications for refractory materials, and did much to encourage the development and adoption of standardized methods of testing these materials. It would, therefore, be fitting that the gas industry should take the lead in this further step forward, and take measures to see what degree of standardization is immediately possible and to what extent a more complete standardization can be evolved.

APPENDIX.

SUMMARY OF 25 YEARS' WORK OF THE SOCIETY OF BRITISH GAS INDUSTRIES.

Year.	No. of Members.	
1905		The Society was formed as the result of Conferences at the Earl's Court Gas Exhibition, London, 1904.
1906	36	As the outcome of a paper on Contracts and Specifications delivered before the Society by Mr. C. E. Brackenbury, it was decided to approach the Institution of Gas Engineers to discuss the question of Standard Conditions of Contract.
1907	55	Gas Exhibition at Manchester organized by the Manchester Institution of Gas Engineers and the Society.
1908	62	Conference on the Standardization of Refractory Materials.
1909	65	Adoption of Standard Conditions of Contract between the Institution of Gas Engineers and the Society of British Gas Industries.
1910	82	Adoption of Standard Specifications for Firebricks by the Refractory Materials Committee of the Institution of Gas Engineers and the Society of British Gas Industries. Establishment of the Livesey Professorship of Coal Gas and Fuel Industries at Leeds University.
1911	84	Co-operation with the Institution of Gas Engineers in the formation of the British Commercial Gas Association. Co-operation with the Manchester District Institution of Gas Engineers in their scheme for the education of gas-fitters.
1912	102	Scheme for National Gas Exhibition at the White City in 1913 adopted. Further Conference between the Institution of Gas Engineers and the Society of British Gas Industries on the testing of Refractory Materials, and Standard Specifications adopted.
1913	115	National Gas Congress and Exhibition, White City.
1914	120	Joint Committee set up between the Institution of Gas Engineers and the Society on the question of the "Life of Gas Meters."
1915	120	Chiefly matters arising out of the war.
1916	118	Co-operation with the Institution of Gas Engineers and the British Commercial Gas Association and the Gas Companies' Protection Association in the formation of the National Gas Council. Revision of the Standard Conditions of Contract between the Institution of Gas Engineers and the Society of British Gas Industries.
1917	119	Standard Form of Guarantee for Gas Meters agreed upon by the National Gas Council and the Society of British Gas Industries. The Society was represented on the Parliamentary Committee of the Institution of Gas Engineers which prepared a report for the Government on the Conservation of Coal from the Gas Industry's point of view.
1918	120	The Society, through the Gas Stove Section, was in close association with the Director of the National Kitchens, and materially assisted in the provision of special gas apparatus for the requirements of the various kitchens and restaurants which were established throughout the country.
1919	123	Co-operation with the British Commercial Gas Association in relation to the Government Housing Scheme.
1920	122	Paper on Carbonization for the Annual Meeting of the Institution of Gas Engineers. Rules agreed between the Operative Bricklayers' Society and the Society of British Gas Industries having reference to the engagements by the firms concerned of bricklayers as retort setters.
1921	120	Revision of Railway Classification of Goods. Paper on Tar Distillation and Sulphate of Ammonia Manufacture, for the Annual Meeting of the Institution of Gas Engineers.
1922	119	Standard for Gas Valve Flanges agreed upon between the Institution of Gas Engineers and the Society of British Gas Industries. New Standard Capacity Gas Meters recommended by the Joint Committee of the Life of Gas Meters adopted by the Institution of Gas Engineers.
1923	118	Report of Life of Gas Meters Joint Committee presented at the Institution of Gas Engineers Annual Meeting.
1924	125	British Empire Exhibition, Wembley. New Agreement between Section 1 of the Society and the Amalgamated Union of Building Trade Workers. Register of Names of Gas Apparatus adopted.
1925	128	British Empire Exhibition, Wembley. Revision of Standard Specifications for Refractory Materials. Registration of Trade Mark "SOBGI." Standardization of Gas Valve Flanges.
1926	132	Specification for Strip and for Tubes recommended by the Wrought-Iron Tubing Committee approved by the Institution of Gas Engineers.
1927	137	Agreement between Section 1 and the Amalgamated Union of Building Trade Workers revised.
1928	138	Co-operation in World Power Conference—Fuel Conference. Co-operation in the work of the National Illumination Committee of Great Britain. Standard Specification for Street Lighting; co-operation with the British Engineering Standards Association. British Industries Fair, Birmingham, Gas Section and Carbonization Conference.
1929	137	British Industries Fair, Birmingham, Gas Section and Joint Gas Conference. Home Office, Factory Inspection Department; co-operation of the Society on the question of prevention of accidents in connection with repairs to gasholders.

Year.	No. of Members.	
1930	138	British Industries Fair, Birmingham, Gas Section and Joint Gas Conference.
		Board of Trade Committee on Deaths from Gas Poisoning. Co-operation with the National Gas Council.
		Conference of representatives of the meter section with the Association of Statutory Inspectors of Gas Meters with a view to avoiding fresh Board of Trade instructions on the subject of Gas Meter Testing.

Mr. West concluded by giving a list of Presidential Addresses and Papers read before the Society.

Discussion.

Mr. C. A. GOODALL, in proposing a vote of thanks to Mr. Frank West, said that mention had been made of the formation of the Society in connection with the Gas Exhibition in 1905. He was engaged with a firm which exhibited there, and he little thought that he would have the honour of being Chairman of the Society then formed before 25 years had passed. The Appendix to the address gave in a concise form all the activities of the Society during its existence in connection with the progress that had taken place in the industry; and it could be said that the Society had done what was expected of it. In regard to the question of refractories, looking at it from the point of view of those who had to use refractory materials, they did appreciate very much the scientific research which had been carried out. The gas industry should not be embarrassed by the old-fashioned laws under which it had to work; it should be given equal opportunities with the younger industry of electricity. There should be fair play; and if that were given the gas industry would be enabled to go forward on equal terms with the newer industries.

Mr. R. J. MILBOURNE, who seconded the vote of thanks, remarked that, although the Chairman of the Council had expressed his satisfaction with the healthy condition of the Society, much still remained to be done; and he himself was tempted to suggest that as the meetings of the Association were only held twice a year, too little time was devoted to them. Looking through the Appendix, it seemed that, while the Chairmen had always contributed papers, only nine other papers had been given by members of the Society during the 25 years of its existence. This appeared a small proportion; and it would be to the advantage of the Society if the sessions of the meetings were lengthened so that members could read technical papers for discussion. The position in regard to co-operation between the various organizations in the industry was now much better than it was when it was last mentioned at a meeting of the Society, because since then the Institution of Gas Engineers had obtained its Royal Charter, and most of the members of the Society were eligible for election as members of the Institution. In that way they had facilities for assisting the industry in the direction of research and in other ways. One matter which should be taken into consideration by all the organizations connected with the industry was that the meetings of different bodies often clashed, so that members were compelled to give up one meeting in order to attend another. It would be a distinct advantage to the industry as a whole if all the organizations were housed in one building. Some years ago, as the address pointed out, standard conditions of contract were settled, and they were revised in 1907. Surely the time had come when these conditions should be revised again.

The CHAIRMAN: That is under consideration now.

Mr. MILBOURNE said he was very pleased to hear this. He wished to emphasize the observations in the address in favour of more money being spent on research. During his own Chairmanship of the Society he had made the suggestion that there were ample grounds for research work being undertaken, and it would reflect to the credit of the Society, and be extremely useful to the industry, if the Society could undertake more experimental work. The work of the British Commercial Gas Association was fully appreciated. The Society contributed to the funds of the B.C.G.A.; and he did not know whether he was disclosing any secrets of the Council in saying that the question of increasing their subscription to the B.C.G.A. would probably be discussed at no distant date. The gas undertakings, however, might do a little more than they now did. The address also mentioned the important subject of the use of gas in industry—a field which the gas industry would have to explore. The National Gas Council at present had the question under consideration, and most of the larger gas undertakings in the provinces intended to place their research laboratories at the disposal of the smaller undertakings, so that the increase in the use of gas for industrial purposes would undoubtedly be very great in the near future.

As to standardization, he felt doubtful whether it did not, in a great measure, stop progress if they slavishly followed standard designs, particularly in such work as retorts.

Co-Ordination.

Mr. R. B. HODGSON, supporting the vote of thanks, said there were two matters he wished to stress. One was the desirability of the members of the gas industry being able to meet as one big organization. In America there was one big organization which brought together the technical men, the salesmen, the propaganda side, and all other aspects of the industry. In this country, however, they were split up. The gas industry, however, was one great business; it did not matter whether they were considering carbonization and the manufacture of gas, or whether they were advertising the sale of gas, or whether they represented the manufacturing side of the business. He believed the time is not far distant when it would be possible to co-ordinate the various societies in the gas industry into one organization which would be worthy of the industry and would be really representative. The time had also come when there should be a central fund which would be at the disposal of any firm or any gas engineer, who could thus develop ideas.

A Central Laboratory.

Mr. F. C. TILLEY said that he much appreciated the reference made to the necessity for joint investigation of the problems arising in connection with the industry. For some years he had, as opportunity had arisen, advocated the establishment of a central laboratory, to be supported by the whole industry, where the vital problems concerning it could be thoroughly investigated; and things were tending in that direction. The time must come when those in the industry pooled their brains; it was a waste that investigations of a similar character should be carried out simultaneously by different people. The industry could not afford to go on doing this year after year. He therefore hoped that the time would soon come when there would be such a central laboratory in which the problems of the industry could be investigated by scientific men, somewhat on the lines of what was being done in Leeds University, but probably in a less academic way, and by coming into closer touch with the practical men of the industry than was the case at Leeds. In saying this, however, he was not saying a word against the Leeds University. He had a great admiration for the work done there. But what was desired was a quick means of solving problems relating to the industry such as would be offered by a central laboratory maintained by the industry as a whole. As to standardization, he had spoken on this on various occasions; and his view was that the greatest care must be taken that there was only standardization of parts and not standardization of design, because standardization of design meant stopping progress.

Research on Refractories.

Dr. HAROLD COLMAN, as Chairman of the Joint Refractories Materials Committee of the Society and the Institution of Gas Engineers, said it was from the time that Joint Committee was formed that extensive research on refractory materials really started. The Joint Committee was formed in 1907, or thereabouts, and therefore had been in existence for 23 years. He had been connected with the work the whole time; and at the first meeting certain difficulties arose. There were others in the room who would bear him out when he said that at that time the view was held that the interests of the users and the manufacturers were opposed; but it was soon found that the two interests were common; and, from the moment that view was appreciated by both sides, progress took place. Nobody would disagree with the claim that the last 25 years had seen great advances in the quality of refractory materials; and this had enabled those increased results to be obtained on the gas-works to which reference was made in the address. He did not claim, for a moment, that all the increased results were due to the research conducted by the Joint Committee; but he did claim that this work had been one very big factor in securing these improved results. In 1921 the British Refractory Materials Research Association was formed, which comprised, manufacturers, users, and scientific men interested in all the branches making or using refractory materials. Mr. Frank West was Vice-Chairman of that Association, and he had done, and was continuing to do, good work for that organization. Such a Research Association in the nature of things was bound first of all to devote its main attention to fundamental knowledge. So far as its funds would allow, the Research Association undertook research which might have a special application to a particular industry. It might be said that this could be carried too far, but he was certain that the valuable results obtained from research into methods and processes applicable to one particular industry had a reaction upon all other industries concerned with the use of refractory materials. However, the Refractory Materials Research Association could not get on without money. Those who were conducting the affairs of the Association might have the best will in the world, but unless they had the wherewithal to pay (he regretted to say often inadequately) the members of the staff, it was impossible to go forward. During the whole time the Refractory Materials Research Association had been in existence it had been suffering from insufficient funds for carrying out the researches which were desirable. It was only possible, therefore, to pick out of the various problems which required investigation those which seemed to be the most important. Naturally there would be differences of opinion, and possibly rightly, as to whether the Council of the Research Association had always chosen the subjects which were most suitable. This was a matter upon which there was always certain to be differences of opinion; but the Council of the Association and its Director, Dr. Mellor, had endeavoured to deal with what they regarded as the most important matters for investigation. He asked the members of the Society of British Gas Industries to help research to a greater extent even than they had done in the past.

Horizontal Settings.

Mr. C. R. F. THRELFALL said that it was impossible to standardize the quality of refractory materials, because any attempt in that direction would result in the quality going down. At the same time, something must be done in the matter of standardization. Individual refractory material manufacturers ten years ago were making only one brand, but now they were making four or five different brands; and for every brand it was necessary to keep a stock of the common sizes, which meant that money that ought to go in development of new and better refractory materials was really going into the yards, and a great deal of money was locked up in stock. It was therefore necessary to do the utmost possible to cut down the number of sizes and shapes of refractory materials, and to eliminate the odd shapes which were so difficult to make and were also very unsatisfactory in use. He had always regarded the ordinary horizontal gas retort as a *tour de force* on the part of manufacturers, and that if they were made in smaller sections the brick maker could employ much better materials. At the present time the brick manufacturers were tied down by the limitations of their materials, and, therefore, when a

horizontal gas retort was demanded, the result must be a compromise, and the brick maker could not really get the best out of the material available. If it were possible to standardize horizontal settings it would be a very great advantage. It would, of course, be necessary to consult other interests besides those of the refractory material manufacturers—for instance, the manufacturers of mouthpieces and charging machinery—but he felt that the time had come when a start should be made. Mr. West had touched upon the improvements made in refractory materials during the last ten years, due to research. Undoubtedly, they had more knowledge about refractory materials to-day than they had ten years ago; but whether those improvements had been applied to the fullest extent was another matter. It was not always easy, although a thing was known to be right, to incorporate it in practice. Conditions generally rendered it necessary to proceed slowly. They must not overlook silica, which had made enormous strides in recent years. At the same time, people were apt to forget the big improvements made in fireclay products. To-day it was possible to treat fireclay in the manner it should be treated for specific purposes, and they should not blind themselves to the fact that improvements had been made in firebrick which had kept pace with the improvement in silica brick. The gas industry had gone in largely for silica, and rightly so; but he was convinced that before long fireclay would come into its own again.

Lighting.

Mr. F. J. Gould said he never thought he would have lived to accuse Mr. Frank West of sins of omission, but in his address he said: "If once the idea is allowed to gain ground that gas is out of date, that it is failing to offer the best medium for the scientific utilization of coal and the best and most economical methods of heating, cooking, and the many heating processes in the industry generally. . . . " Surely there should be added there a reference to gas lighting. He could not help feeling that the B.C.G.A. should support the lighting side of the industry as much as it did the other branches, and for that reason he would have liked to see a reference to lighting in the paper.

The vote of thanks was then put to the meeting and carried with acclamation.

Mr. West's Reply.

Mr. Frank West, replying to the discussion, said he had endeavoured in his address to deal with matters that were not too controversial, and to give something which would be of interest to the members. At the same time, he recognized there were things in the paper that could be criticized. Mr. Gould had mentioned lighting, but seemed to have overlooked that the paper also mentioned "domestic amenities," which surely included lighting. He very much appreciated the remarks of Dr. Colman on research, and those of Mr. Tilley and of other speakers who referred to standardization. He had brought that matter forward because he felt it was one which should be given considerable thought. It was not suggested that they should standardize sizes altogether, but an endeavour should be made to get down to smaller shapes and forms, so that the manufacturer could produce a better material more cheaply for the user.

Mr. West proposed a cordial vote of thanks to Lord Eustace Percy for presiding. Everybody had appreciated the address Lord Eustace had given at the luncheon; and the members were looking forward to a closer association with Lord Eustace Percy before his office came to an end.

The vote of thanks was carried unanimously.

The President, expressing his appreciation of it, apologized for having been of little use to the Society during the last six months. At the same time, he expressed his pleasure at having been present at the meeting. He had been reminded during the meeting of the sad history of the Gas Bill, and he could only express the hope at the moment that the Mother of Parliaments would soon do her duty in that matter.

Gas Companies' Protection Association

Pressing Problems of the Industry Reviewed

The Thirty-Third Annual General Meeting of the Association was held on Thursday last, at Caxton Hall, Westminster. In the absence through indisposition of the Chairman, Mr. R. W. Edwards, J.P., the proceedings were presided over by Mr. R. Bruce Anderson, the Vice-Chairman. Mr. Edwards had prepared an address for the occasion, which Mr. Bruce Anderson read, with some interpolations which are reproduced in italics.

The Chairman, in opening the proceedings, said: I am sure you will join with me in expressing regret that Mr. Edwards is unable to be present, and in wishing him a speedy recovery. He is a man of many parts, and has just entered on his second year of office as Mayor of Aldershot. He held his Mayoral Banquet on Friday of last week, at which, with about 300 others, I had the pleasure of being present, and was glad to note how popular he was in quite a different sphere from that in which we are accustomed to see him. I am sure I am acting in accordance with your wishes in asking the Secretary to convey an expression of our feelings to Mr. Edwards, who has telegraphed his good wishes for a successful meeting. ("Hear, hear.") We are pleased to have with us one of our Vice-Presidents, Mr. Reginald G. Clarry, whom we welcome back from America, where he has been on our behalf in connection with tar.

The Assistant Secretary (Mr. R. G. Cooper) having read the minutes of the previous meeting,

The Chairman proceeded to read the following:

ADDRESS OF MR. R. W. EDWARDS.

Accounts.

The past financial year of the Association has again been satisfactory, the surplus on revenue account being £101. Although the figure for the previous year was £132, the difference is due to the expenses of the increased activities of the Association and not to any falling off in subscriptions, which have actually increased.

The assets now amount to £2616 7s. 3d., including £2200 of 5 p.ct. War Loan (at cost £2142 0s. 8d.). The Bank Balance is £468, of which £350 have now been placed on deposit, with a view to investment in due course. Since the date of the report, the outstanding subscriptions have been reduced to twelve guineas.

During the past year the Association has continued to give to members practical information and advice on individual matters.

The Income-Tax Sub-Committee has dealt with many questions connected with taxation and rating, and reference to the report will show that many companies have availed themselves of Mr. Cooper's knowledge and experience on a wide range of subjects.

The Past Year.

A broad survey of recent events makes it clear that the gas industry has already entered a somewhat critical period. Changes are in the air, and, as I foreshadowed at last year's meeting, steadily growing competition has to be faced. Were it not for my experience of the way in which our industry has in the past met and overcome times of difficulty, I should now have to confess to some misgivings.

Before touching upon the vital aspects of the present outlook, I must refer to some of the more important matters mentioned in the report.

Coal Gas Poisoning.

As you know, the Departmental Committee appointed to consider the question of deaths from gas poisoning reported to the Board of Trade in February last.

I was able to keep in very close touch with the progress of this inquiry, receiving a special report of every public meeting, and the skill and thoroughness with which the Committee dealt with the problems before them adds great weight to the value of their conclusions. It is generally agreed that the recommendations which they have published are not only sound in themselves, but also satisfactory to the gas industry. The evidence which was heard fully disclosed the undoubted tendency to record as accidental many deaths that were in fact due to suicide.

It also enabled the Committee to examine and discard various ingenious but impracticable proposals which have been put forward, and at the same time to recommend certain well considered precautions by which additional safety might be obtained. As you will see from the Association's report, steps have already been taken to give effect to these recommendations.

There are two points to which I would particularly draw your attention. First, I would stress the desirability of every undertaking, in its own and the general interest, sending to the Board of Trade the fuller details now asked for in connection with gas fatalities.

> [*I feel sure we all approve of doing this, but fortunately, with many of us, cases of gas poisoning are few and far between, and unless machinery is provided to keep the matter in mind, I fear the notification desired by the Board of Trade may be overlooked. Those of us who keep perpetual diaries can make a reminder note in them; but I think it would be a useful thing for our Association to send with its receipts for subscriptions a leaflet each year reminding gas companies of the desirability of sending the desired information to the Board of Trade—the leaflet recapitulating the nature of the information.*]

Secondly, the Association has undertaken to urge its members to put into effect the Committee's recommendations as to the inspection of gas fittings and apparatus.

In addition to ensuring greater safety, these inspections are found in practice to lead to increased business in the way of new orders and satisfied consumers.

The evidence given by Mr. Stokes was heard after the date

of our last annual meeting, and I welcome this opportunity of expressing to him the thanks of the Association.

Conjoint Conference.

The Association has continued to participate in the activities of the Conjoint Conference of Public Utility Associations. This body was formed, as you will remember, for the purpose of temporary joint action in connection with highway problems, but experience has shown that there are many other matters in which it may perform useful functions.

To enable it to continue its activities on a more solid and regular basis, a proper constitution for the Conference has been drafted, and is at present under consideration.

Monopoly of Footpaths.

Last November I referred to the difficulties which had been experienced through the use made by the Post Office of the available space beneath footpaths and pavements.

As this is a matter affecting all utility undertakings, it was taken up by the Conjoint Conference, who have now received from the Postmaster-General assurances that the claims of all undertakings concerned will receive practical consideration from his Department. He mentioned also certain provisions which are at present in force to minimize interference with subsurface works. The text of the letter in question has already been circulated to members.

The personal factor is, of course, of practical importance in these matters, and from the information collected, it appears that in the majority of cases a little give and take on each side results in mutually satisfactory working arrangements.

Finance Acts, 1927 and 1930.

A matter of less general interest, but one which should not be overlooked, concerns the provisions of the Finance Act, 1927. These in effect abolished the liability in certain cases of amalgamation or absorption, to pay further stamp duty on capital which has already borne duty under the Act of 1891.

Owing to the representations of the Conjoint Conference to the Chancellor of the Exchequer, the new Finance Act has extended the exemption to capital issued before 1891, and has thus placed all undertakings—however venerable—on the same footing.

A further and most desirable amendment was also put forward, dealing with the question of compensation to officials, but the Treasury could not see their way to accept this.

Although these are points of no immediate concern to many of our undertakings, yet any step to assist the attainment of efficiency by rationalization, is of value to the industry.

[*In connection with Stamp Duties, members may be interested to be reminded that the duty is not payable upon premium capital, and any who have raised premium capital are entitled to recover the duty thereon. It has just been done by a Company which obtained further capital powers under the Gas Undertakings Act, which deducted from the duty payable thereon the percentage on the premium capital which had been paid when the previous lot of capital was authorized.*]

Coal Mines Act.

Turning to matters of more widespread concern, we have watched the Coal Mines Bill survive a stormy passage to the Statute Book. Coal being the fountain head of our national prosperity, and the very lifeblood of our particular industry, it is natural that the Bill should have claimed universal attention and its full share of opposition.

An industry wholly dependent upon its product, necessarily wishes to see coal mining maintained at the highest pitch of efficiency. So far as the Act will assist joint working, rationalization, and effective distribution, it is therefore welcomed.

Other portions of the Act can only be regarded with misgiving. Very wide powers are given to the owner's councils, and although the safeguards offered to consumers have been strengthened in the Bill's passage through Parliament, they cannot be regarded as substantial.

One of the most disquieting features of the measure is the unobtrusive definition of "class of coal." This enables different industries to be charged differently for exactly similar coal.

Thus, while the interests of formerly competing coal mines are now consolidated, those of the different classes of purchasers may be artificially made to conflict. This might well lessen the effectiveness of the Committees of Investigation, by undermining the solidarity of the consumers. It is an important matter that gas interests should be properly safeguarded by these Committees, but their constitution, so far as at present published, does not give to gas the representation to which I feel it is entitled.

The cost of coal is a far bigger item in the working costs of the gas industry than in that of any other. Gas is the largest industrial purchaser of coal in the home market. It consumes some seventeen million tons per annum. Moreover, the cost of gas directly affects the cost of living of the majority of the country's population.

There are other points which give cause for uneasiness. Restriction of output may mean less efficient working in many pits. Restriction of choice of market must prejudice purchasers. The two consecutive reductions in working hours, which are now imminent, are likely to add further to the price of coal by increasing the cost of production. This will especially affect those pits where the coal face is at a distance from the shaft. Finally, the cost of working the machinery set up by the Act cannot be left out of account.

Much will, of course, depend upon the use which is made of the powers given to the owners. Their abuse will, I am sure, be exceptional; but gas undertakings can hardly welcome the fact that such wide powers have been given to that industry which is not only the supplier of their raw material, but at the same time an active competitor for both heating and cooking.

While the Bill was before Parliament, gas interests have, through various channels, made strong representations to the Government and to both Houses. Some benefits have materialized in the various amendments with which you are all familiar; the export levy, spread-over, and right of appeal being the points most concerned. These go but a short way to meet the case put forward by our industry, but the measure is now on the Statute Book, and we must rely upon such protection as it offers.

We may no doubt rely also upon the realization by the coal owners that we are not only their best industrial customer, but also the only one which uses, and must continue to use, coal as its raw material.

The transport industry is being taken from the railways by the petrol vehicle, and we read that even the railways themselves are experimenting with diesel engines, and may not remain entirely faithful to steam. Many electricity undertakings have already forsaken King Coal for the more novel attractions of Prince Oil, and modern water and drainage works are favouring electrical pumping, and again oil driven, at the expense of steam. Only gas remains wholly true, and any action by the coal mines tending to weigh her down as she struggles against the tide of electrical competition, would be seriously damaging, not only to gas, but also to the mines themselves.

[*Since Mr. Edwards prepared his notes, a crisis has developed in connection with the coming into operation on Dec. 1 of a part of the Act. We hardly know whether we are faced with a strike or not. Whether or no, the mere crisis will have caused many of us to have incurred a heavy premium for insurance indirectly, by laying in heavier stocks of coal than would be necessary if we had only to consider the Acts of Providence and not the Acts of irrational man.*]

Area Gas Supply.

A question of outstanding interest has been exhaustively examined by the Committee set up by the Board of Trade to inquire into proposals for an Area Gas Supply. A report was published in June dealing in great detail with the technical aspects of the scheme, and fully reviewing the possibilities of a system to produce an inter-connected supply somewhat on the lines of the electricity "grid." This report has undoubtedly done much to clear the air and dissipate the many uninformed—though sometimes plausible—theories and proposals which have been put forward.

Many of these have been inspired by the progress already achieved in the way of long-distance supply in Germany and elsewhere; but the Committee have clearly stated the conditions in England to be so unlike those in Germany, that each country has to be considered on its merits as an entirely separate case.

To mention only one point of difference; in 1926, when the German system may be said to have first started, gas-works in Germany were supplying only 1800 c.ft. per annum per head of population, while the equivalent figure in Great Britain was 6000 c.ft. This shows clearly the immense potential demand for domestic supplies waiting to be met in Germany. In this country the domestic market is more nearly saturated, and one of the chief fresh outlets now available is in the industrial field.

The report states that if it is planned and carried out on proper lines, an area gas network confined to South Yorkshire should be a practicable and successful enterprise. I understand that steps are already being taken to obtain the powers necessary for this scheme. The conditions in the other districts considered by the Committee were thought not yet able to justify any development on similar lines.

It is of interest to note that the report recommends the retention by authorized undertakers of the exclusive control of all distribution, except in special cases with their consent; also, that it was considered that no element of compulsion would be required.

A point emphasized throughout the report is the need for stimulation of the industrial use of gas. It was urged that this must be for the benefit both of the industries supplied and of the undertakers; and that so far as possible every obstacle in the way of a cheap and abundant industrial supply should be swept aside. It was thought that a very large demand would be obtained from the iron and steel interests if they could be offered gas at a price of approximately 2d. per therm.

In Sheffield it was stated that certain steel works were already being supplied at 2·4d. per therm.

[*In connection with large consumers, I would sound a note of warning to those in charge of small undertakings to be very careful in taking on large consumers whom it would be embarrassing subsequently to lose. I know of several gas undertakings, which have been seriously crippled by the loss of a comparatively large consumer, which rendered it necessary to spread irreducible overhead charges over the remainder of the business, causing profit practically to disappear. Price of gas is reduced, in consequence of profit made on the large consumer—he goes—and if the price be raised, a shrinkage in the remainder of the business results.*]

Last November I had the pleasure of asking you to express to Mr. H. E. Bloor the thanks of the Association for the work he had done in connection with his evidence before the Committee.

That the value of such evidence was fully appreciated is shown by the fact that at a later stage he was called upon to assist the Committee further.

On behalf of the Association, I wish to thank Mr. Bloor for the able services which he rendered.

I have spoken solely of the technical side of this report, and it must be borne in mind that the Committee's terms of reference placed before them technical problems only. The report points out this fact, but continues as follows:

> Nevertheless we are so convinced of the general need for some amelioration of the present conditions under which gas undertakings operate, that we consider ourselves justified in dealing at some length with this matter.

In another passage, after mentioning the advantages looked for from rationalization and reciprocal working agreements, the Committee state:

> We think it desirable that the industry should be granted the greatest possible freedom consistent with the need for a certain measure of control. . . .

Another body also, the National Fuel and Power Committee, were convinced of the necessity for an improvement of these conditions, and in their Second Report recommended that many far wider powers should be made available without the slow and costly procedure of Private Acts or Orders. The latter Committee also said:

> We are of the opinion that the two-part system of charge is calculated to lead to more advantageous working, and is, in the long run, the fairest method of charge.

This passage is quoted by the Area Gas Committee, with the following comment:

> We desire to associate ourselves with this view. In our opinion, the introduction of a more scientific method of charge . . . is vital if an expanding market for gas is to be found.

This statement follows naturally from the view of the Committee, for which I must again quote their own words:

> It is our considered opinion, and one that we shall stress continually in this report, that industry must have cheap gas.

I want to call your attention, and the attention of all concerned, to a fact as significant as it is depressing. While unemployment has been steadily rising, and our industrial prosperity as steadily declining, two disinterested bodies of the highest possible qualifications, examining practical problems from different points of view, have urged that certain legislative steps are required for the benefit of industry. Their recommendations are unanimous, they are unambiguous, they are constructive, they are simple, and they are comparatively non-contentious. In spite of this fact, our industry has received from the legislature no assistance beyond the Gas Undertakings Act. We are told that Parliament is too busy; that other measures must come first, and continue to come first; that we must attribute all industrial troubles to world conditions. Although as a country, we stand or fall by our industries, we are told, in effect, that social services must be further extended before anything substantial can be done to help the industrial goose to lay the necessary golden eggs.

With regard to the present Session, we find in the King's Speech only a vague and passing reference to measures for the assistance of industry. However, our claims are being steadily pressed, and it is earnestly hoped that an adequate measure may be brought before the House in the not distant future.

Meanwhile, the practical question of demonstrating and initiating the use of gas in new industrial and commercial uses is already receiving attention from the National Gas Council. The Council quote the tremendous consumption for these purposes in the United States, and propose a survey of the possibilities in this country, with a view to combined action by groups of undertakings.

The Present Outlook.

As already mentioned, the present is a critical period. We are faced with two serious problems; electrical development has reached a stage at which the serious competition for heating and cooking has begun, and, in a wider field, the industrial life of the nation calls urgently for means to escape disaster. It is a call which must be answered, and to my mind it cannot be answered fully by any government policy or action, unless backed by the support and effort of every individual, every company, and every industry in the country. Capital and labour, science and skill, genius and management, must strive together towards a common goal of efficiency.

The material is already to hand. Sir William Morris has publicly expressed rare praise of British workmanship, and he spoke only of what he has himself manifestly proved. His industry more than any other has shown the nation what results can be achieved—given the right economic atmosphere and progressive management. Just as the best of seed in the richest of soil can produce nothing without rain and sunlight, so also our country's industries cannot flourish without the will to succeed and reasonable freedom. Electricity and the motor trade have been given also legislative stimulants in different forms, and the growth of each in the last few years has been remarkable.

What of our own industry? Labour, skill, and brains of proved merit are available, and we have not far to look to see that sound undertakings can still attract ample capital. It rests with us to add the dews of inspiration and driving force. The only barrier to progress and success is the statutory cloud of out-of-date legislation.

I have mentioned two problems that confront us; electrical competition and general depression. To my mind, both should be faced in the same way. We must increase our own efficiency, and press for Parliamentary freedom to do so.

Sterling work is being done by Sir Francis Goodenough in pointing the way to better and more enlightened salesmanship, especially in the field of gas. The full benefit of this work cannot be obtained unless it is properly backed by the producing side of our industry. We know that greater sales will bring down costs per therm, but we must not forget that nothing will help our salesmen so much as reduced prices.

> [*In connection with this, I, in company with several others, am feeling rather appalled at the way the cost per therm is mounting up for selling our commodity. Savings effected after much striving in the retort house are more than swallowed up in the showroom. Oil for lighting is still very much used, without, so far as I have noticed, much advertising; and one is inclined to consider whether the cost per therm of showroom, &c., given as a reduction in price, would not be more effective in attracting, and more particularly in retaining, business.*]

Granted the need for increasing consumption by cheapening supplies, what practical steps should we take? The developments covered by that overworked word "rationalization" can offer many benefits. If the interests of many small individual undertakings can be skilfully combined, either by joint working agreements or by actual amalgamations, greater efficiency must result.

With larger units, capital charges will be lessened, for a freer market and greater security will attract money on better terms. Coal contracts on a larger scale can be negotiated more favourably. Residual products of better and more uniform quality can be produced. By means of connecting mains, inefficient or out-of-date works can be eliminated, or, alternatively, enabled to increase their production with less stand-by plant.

Management and office expenses, and the benefits and cost of research and laboratory work, as well as Parliamentary expenditure, can be spread over a bigger output. All these advantages are matters of common knowledge, and, apart from legislative restrictions, the main difficulties in their adoption are often merely personal matters and questions of sentiment. If these are viewed with a proper sense of proportion, they will not be allowed to stand in the way of the public interests. The electrical industry is already reaping the fruits of a rationalization made possible by far-sighted and enlightened statutes.

The proposed gas network in South Yorkshire, if carried through, will no doubt lead to many of the benefits to which I have referred. In another way also it may do good in educating industrial consumers to new uses for gas, and so stimulating similar demands elsewhere. In many districts the industrial outlet may not be a matter of great importance, although it has been stated that there are in all over 4000 distinct trades using gas for approximately 20,000 industrial processes.

Every district, however, will be concerned as to the possibility of new demands from the domestic market. Some of us can remember the time when gas was hardly used for purposes other than lighting, and it is not unreasonable to foresee an almost universal demand, not merely for cooking and gas fires, but for purposes of central heating and constant hot water. Every housewife seeks to eliminate labour, and her object cannot be completely achieved until the use of solid fuel has been wholly abandoned.

To capture and retain these new outlets, it will certainly be necessary to use entirely new methods of charge, either two-part tariffs, a block system, or differential rates; and in most cases this cannot be done without alteration in the existing

sliding-scale provisions. A further point needing careful investigation is the effect of these developments upon coke markets.

[*Much attention is being paid at present to adopting a smaller quantity than the therm, upon which to state the price of gas. When the therm was introduced, many of us thought a smaller quantity was desirable. Now more seem to be of that opinion. It seems very natural to adopt a Gas Unit containing the same energy as the Electrical Unit. It is certainly rather small; but as it is not likely the Electrical Unit will be altered it would be reasonable to come down to a level with it for a Gas Unit, so that prices of gas and electricity would be directly comparable.*

Here, again, for some, legislation may be necessary. I have been advised in connection with two Companies by their lawyers that they may sell only by the therm. In examining the matter, I was struck with the significant change in phraseology which has taken place in Acts and Orders. Old Acts and Orders referred to "Price to be charged," whereas new ones refer to "Price for gas supplied." The wish perhaps being father to the thought, encourages me to suggest that the new phraseology restricts the standard price to regulating the dividend, and leaves the price to be charged more at the will of the Company.]

It is clear that if gas is to hold its own, it must keep abreast of the times, and this it cannot do under existing general legislation. In 1847 and 1871, gas held a complete monopoly, and the safeguards imposed 80 or 60 years ago may well have been necessary to protect the public. Now, in 1930, conditions are completely reversed, and the thirty odd million users of gas are being supplied under highly competitive conditions. In these circumstances, we ask for the removal of restrictions which, so far from protecting the consumer, are now actually preventing him from receiving the full benefit of competitive prices. In the long run both consumers and shareholders are now actually being prejudiced. In the common interests of both, the industry asks for freedom—not to increase the price of gas, but to supply for less.

I trust my words to-day will pass on to all our subscribers, and that it will be realized that an Association such as this, is for the purpose of assisting in the solution of the problems mentioned. As one who believes in the gas industry's future, I express the hope that the generation who must take our places will, with the passage of time, gather up the threads and enlarge our fields of usefulness, by courage and efficiency.

Retirement of Mr. Whittaker.

Before concluding, I must refer to the loss which the Association has suffered in the retirement of Mr. W. F. Whittaker from the Committee. I know that you will join me in thanking Mr. Whittaker for his most active and regular services as a Committeeman during the past eight years. His retirement is a matter for general regret, and many of us will miss him also as a personal friend. Mr. Bloor was co-opted to fill the vacancy, and, in view of his recent work, there can be no doubt that he will prove a most valuable member.

I now have pleasure in moving the adoption of the Report and Accounts for the year ended Sept. 30, 1930.

Sound Financial Aspect of the Association.

Mr. R. G. Clarry, seconding the adoption of the report and accounts, said the address to which they had just listened was worthy of the greatest possible publicity, in the interests of the gas industry. The Association did work which was very valuable to the industry, and which it was specially fitted to do. Whatever might have been the case at one time, in no sense had gas undertakings a monopoly to-day. They must organize and stand wholeheartedly together on every issue of real importance, and in the Association they had a most useful asset. He himself had now come into more active work in the industry in relation to tar. There was a lot of work to be done there in the future. To-day conditions everywhere were more or less depressed, and perhaps the only bright spot was in connection with road construction. While, therefore, there was this bright spot, they should make the most of it by resolving to secure a larger share of the business. The Association had done particularly good work in connection with legislation and parliamentary affairs; and it was here that the help of the Secretary and Assistant Secretary was so indispensable. His own earliest experience of the Association was as assistant at Swansea to the late Mr. George Andrews, who took full and frequent advantage of the advice which he was able so readily to secure from the Association. He congratulated those concerned upon the sound financial aspect of the Association.

Suggested Small Gas Unit.

Mr. C. F. Botley, supporting the motion, referred to the question of tarred roads as affecting rivers, and said the industry should be very careful to see that it was not misrepresented on this subject. The real facts of the matter should be kept well in the forefront. The particular function of that Association, which was a constituent part of the National Gas Council, was to watch over the particular interests of company-owned undertakings, and it had accomplished invaluable work when no one else was able to do it. It would be unfortunate if the members should forget the assistance which was available to them.

With regard to the remarks that had been made by Mr. Bruce Anderson on the subject of the advisability of adopting a Gas Unit containing the same amount of energy as the electrical unit, Mr. Botley said he felt it would be altogether premature on the part of the gas industry to introduce any new unit; the therm itself was not yet thoroughly understood. There was no difficulty in making comparisons between the therm and the unit of electricity, and he protested against the introduction of a new small unit, as being a step which he thought could lead only to confusion.

The report and accounts were then adopted.

Elections and Thanks.

Dr. Charles Carpenter, C.B.E., was re-elected President of the Association, on the proposition of the Chairman, who said they could not have a better man.

Mr. R. G. Clarry and Mr. A. A. Johnston were re-appointed Vice-Presidents.

The retiring members of the Committee were re-elected, as were also the Hon. Auditors (Messrs. W. A. Scott & Co.), who were cordially thanked for their services.

The proceedings were brought to a close with votes of thanks to the Chairman, the Secretary, and the Assistant Secretary.

Mr. F. E. Cooper, responding, said it was a great source of satisfaction to his son and to himself that their services were so well appreciated.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

MODERN METHODS FOR THE MECHANICAL PURIFICATION OF COAL GAS.

Modern methods available for the mechanical purification of gas are described by A. Thau, Brennstoff-Chemie, 1930, **11**, 416-418 (Oct. 15), 435-438 (Nov. 1), 455-459 (Nov. 15).

The objects of treating the gas may be summarized as follows:

(1) Removal of useless material.

(*a*) Dust removal. This finds but limited application, since the carbonization process is generally conducted under conditions such that dust formation is minimized. Nevertheless, in gasification processes and in the carbonization of fine coal, dust removal is necessary.

(*b*) Removal of carbon dioxide by compression and liquefaction or by high-pressure absorption in water.

(2) Purification with recovery of bye-products as a subsidiary object—*e.g.*, removal of tar and ammonia. Here, purification is the main object.

(3) Recovery of bye-products—*e.g.*, tar, light oils, and benzole.

Electrical purification has been extensively developed in the last ten years. But it is limited to the removal of tar and dust, and is not applicable to the removal of matter present as vapour or gas.

Dust Removal.

Dust is the most undesirable impurity in coal gas, and before recourse is had to a method for removing it mechanically, it is

good policy to take all possible precautions to minimize its formation. A strong pull on the carbonizing plant is conducive to the presence of dust in the gas, owing to the higher velocity created, and since the dust is covered wholly or partly with an oily film, its wetting is rendered very difficult. It is often the case in coke-oven plant that dust passes right through the coolers, tar extractors, ammonia saturators, and even the benzole scrubbers, and is only deposited later along with naphthalene, so that blockages, very difficult to remove, are caused. The fact that the dust behaves in this way is sufficient to indicate how difficult it is to remove, and how necessary it is to minimize its formation. Some dust is deposited with the tar, and its removal in this manner is a source of great trouble due to the bad effect it has on the separation of tar and liquor. A good commercial tar should, in general, not contain more than 1 p.ct. of dust (coal dust).

The conclusion may be drawn that in all cases where dust and tar are both present, dust removal must precede tar extraction, though it must be pointed out that a sharp separation of the two is, so far, not realizable. Separation of the dust must therefore be effected at a temperature exceeding that of the boiling point of the tar constituents of highest boiling point —namely, above 660° F.—and under these conditions is very difficult or almost impossible. The nearest approach to success has been realized in the case of the Bartling dust extractor. If, with the dust, high boiling tar constituents are deposited, the deposited material forms at normal temperatures an almost solid, very viscous tar. If such a mixture is formed, it is preferable not to employ a special dust removal process, but to regulate the temperature so that more of the tar is deposited. Thick tar is not then formed but the value of the tar is very much reduced owing to its dust content.

Tar Removal.

Tar fog must not be regarded as consisting of hollow bubbles of tar filled with gas, but as very finely divided liquid particles, the aggregation of which into large heavy drops capable of ready settling is very difficult and never complete. A proof of the incompleteness of elimination of tar fog has been given in connection with the introduction of activated charcoal for benzole recovery since even though the gas has been purified so thoroughly that tar compounds are not recognizable by chemical or physical methods, such compounds are, nevertheless, adsorbed and polymerized by the charcoal. The stripping efficiency is, in consequence, so greatly reduced that it becomes necessary to remove these invisible tar constituents from the gas by means of a special pre-filter in order that the activated charcoal may retain its efficiency for long periods.

Tar removal may be achieved by cooling, washing, friction, or shock, either alone or in combination.

Absorption.

The freeing of gas from valuable vapours such as ammonia and benzole is achieved by their absorption in a liquid. Adsorption by solids and fractionation by use of high pressure and intensive cooling will not be discussed in this connection. In many cases, and in most coke-oven plants, the direct or semi-direct process of ammonia recovery is employed. These, too, are not mechanical processes and will not be discussed. Ammonia is removed both on account of its value and owing to its liability to give rise to oxides of nitrogen when gas containing it is burnt. These oxides rapidly attack copper and copper alloys.

Efficient removal of ammonia by water depends on a temperature as low as possible, and intimate and suitably prolonged contact between the gas and the water. Many scrubbers are available—*e.g.*, the Feld washer. The same principles hold good as regards benzole recovery, and similar types of plant may be used.

The Smith Tar Extractor.

This appliance has been developed by the Smith Gas Engineering Company of America for the removal of tar from water gas. The gas is pumped into the extractor which contains a suitably mounted glass-wool filter. On leaving the filter, the gas passes to a separating chamber containing a baffle and a tar reservoir in which the deposited tar collects. The use of such filters has often been attempted but always unsuccessfully, since they quickly became choked with tar and dust. This is avoided in the Smith tar extractor by submitting the gas to a relatively high pressure and causing it to traverse the filter with a very high velocity, exceeding 180 ft. per second. The initial pressure of the gas is 4-5 lbs. per sq. in., and the pressure drop across the filter 2-4 lbs. per sq. in. These are necessary conditions for efficient working of the filter, and a pressure gauge is fitted at the inlet to the filter chamber so that control over the pressure may be exercised. Due to the high pressure required, the power cost is high. The use of such filters is therefore economically possible only when the gas is to be distributed under pressure.

The smallest and largest extractors of this type have filters of diameter 4 and 20 in. respectively, the hourly capacities being 2500 and 40,000 c.ft. For larger volumes, the gas stream is divided, several units being used in parallel. With a filter 0·35-0·4 in. thick, the efficiency of tar removal is 99·5 p.ct., but this figure can be increased to 99·98 p.ct. by use of a thicker filter, though the back pressure and power are considerably increased. In one American plant, 8 million c.ft. of water gas are treated daily in extractors of this type.

In actual use, the filters are arranged in duplicate so that the gas can be diverted to the spare filter when the glass-wool of the one in use needs renewal. The fact that, after a lapse of time depending on the quality of the gas, the filter is choked with dust and not with tar indicates that the filter does not act as a tar filter, but that, on the contrary, owing to the great friction between the gas and the wool, electricity is generated and under its influence the tar fog condenses after the gas leaves the filter. The Smith filter has so far not come into use in the European gas industry.

The Bartling Tar Extractor.

The Bartling tar extractor is a centrifugal machine. The gas is delivered upwards by way of a pipe, the open end of which is fixed into the central hole of a horizontal stationary disc, a few millimetres above which is a disc rotating at high speed. The gas is thrown outwards between the discs by the centrifugal force created, the tar being deposited and collecting in a conical hopper whence it is discharged by way of a seal or a self-sealing rotary valve. The gas free from tar passes upwards in the space between the rim of the rotating disc and a ring fitted into the casing of the machine. The machine may be used, also, as a dust extractor.

Various supplementary devices have been incorporated in the machine to increase its efficiency for certain purposes. The surfaces of the discs may be rifled so as to present, in section, a saw-edge and the stationary disc may be given an electrical charge. An alternative arrangement is the provision of several pairs of discs in one unit. The speed of rotation of the discs depends on the size of the extractor and may vary between 500 and 3000 r.p.m.

For tar removal from about 140,000 c.ft. of low-temperature carbonization gas per day, an extractor, with 5 pairs of discs each of 14 in. diameter and costing £75, has been employed. No data as to the power costs are available, since the power consumption is said to be too low to be accurately measured. Since the disc rotates only in a gas, friction is very low and, to all intents, the only power required is the amount necessary to overcome the friction of the bearings. The gas suffers practically no pressure drop in passing through the extractor.

In connection with the precise location of the extractor in the gas stream, due regard is taken to the most suitable temperature. Extraction of tar must occur at a temperature above the solidification temperature of the tar, but extraction is progressively better as the temperature is lower. Moreover, at low temperatures more light oils are deposited with the tar. It is thus possible to treat the gas so that there will be left in it slightly less than 1 lb. per 1000 c.ft. of hydrocarbons absorbable by activated charcoal, a result which must be regarded as very satisfactory since no other purely mechanical appliance approaches it. Other experiments which have been made so far have been concerned with the results of giving an electrical charge to the stationary disc with a view to dust extraction at a temperature exceeding the dewpoint of the tar constituents of highest boiling point and with an investigation of the effect of introducing relatively small quantities of oil to increase the deposition of light oils. The results which have been quoted indicate that the Bartling machine is very suitable for tar extraction, and that it is, at the same time, capable of removing a large proportion of the light oil present in the gas, depending on the working temperature.

The Feld Washer.

In the Feld washer, centrifugal sprays of the washing liquid are created. The washer contains a column of troughs, from each of which a spray is projected, the droplets, after coming into intimate contact with the gas, returning to the troughs. Liquid overflows from one trough to the next *pari passu* with the addition of fresh washing liquid. These machines have been extensively used for many years for ammonia and benzole scrubbing and have been modified considerably in design from time to time. They are very compact and may be used, also, for naphthalene extraction. They enable relatively strong liquor and benzolized oil to be recovered, and the subsequent distillation costs are therefore low. The author gives details of the performance of Feld washers both for ammonia and benzole recovery.

THE "JOURNAL" TECHNICAL RECORD

Which also contains Full Reports of Meetings of Gas and Allied Associations

Southern Association of Gas Engineers and Managers

METHODS OF GAS CHARGING DISCUSSED

A General Meeting of the Association was held at Grosvenor House, Park Lane, W., last Friday—Mr. FRANK H. JONES, M.Inst.C.E. (the President), in the chair. After the minutes of the previous meeting (as published in the "JOURNAL") had been confirmed,

ELECTION OF NEW PRESIDENT AND VICE-PRESIDENT.

The PRESIDENT said he had a duty to perform now which was at the same time both pleasant and unpleasant. He had greatly enjoyed his year of office, and desired to pay a tribute to their extraordinarily able Hon. Secretary. He would like to place on record his sincere thanks to Mr. Donaldson for all the help he had given him. They all knew Mr. H. C. Smith, of Tottenham, whose election as President for 1931 he was going to propose. For some years past Mr. Smith had had a great deal to do with the Association, and he would make a first-rate President, with his wide experience and recognized ability.

Mr. J. URQUHART seconded the proposition, which was carried with applause.

Mr. SMITH expressed his appreciation of the honour done him, and said that if he could fill the office anything like so well as Mr. Jones had done he would be more than satisfied. He then proceeded to propose for the position of Vice-President Mr. R. H. Ruthven, of Ramsgate, who had in many ways proved himself to be eminently fitted for the office.

Mr. C. VALON BENNETT seconded this, with the remark that Mr. Ruthven's work in connection with the Corrosion of Pipes Committee of the Institution of Gas Engineers was in itself sufficient recommendation.

Mr. RUTHVEN acknowledged his election.

GENERAL COMMITTEE, DISTRICT COMMITTEES, AND DISTRICT EDUCATION COMMITTEES.

The HON. SECRETARY reported the following elections by the Districts:

EASTERN DISTRICT, 1931.

Chairman.—Mr. T. Carmichael.
Vice-Chairman.—Mr. F. Porteous.
Hon. Secretary.—Mr. W. H. Warren.
Committee.—Messrs. A. H. Andrews, C. Valon Bennett, W. H. Bennett, C. F. Botley, D. C. Cross, H. Gage, W. Grogono, L. G. Humphrys, S. Lacey, L. J. Langford, E. L. Nicholas, C. T. Price, R. H. Ruthven, C. H. Rutter, W. J. Sandeman, E. F. Smallbone, A. W. Sumner, J. Terrace, J. S. Thorman, L. Trewby, and J. Urquhart.
Ex-Officio Members of the Committee.—The President, the Vice-President, and the Hon. Secretary for the time being of the Association.
Representatives on the General Committee in place of those retiring by Rotation.—Messrs. W. Grogono, E. L. Nicholas, and E. F. Smallbone.
Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. D. C. Cross, H. Gage, W. Grogono, and S. E. Whitehead.

WESTERN DISTRICT, 1931.

Chairman.—Mr. R. J. H. Clark.
Vice-Chairman.—Mr. J. Harger Pye.
Hon. Secretary.—Mr. J. B. Cattle.
Committee.—Messrs. J. Armstrong, F. Blackburn, J. Hughes Cornish, C. G. Dawson, W. E. Dean, S. E. Halliwell, C. Harris, H. Higham, P. S. Hoyte, J. H. Lowther, H. E. Riley, C. Stapleton, J. Taylor, A. Thomas, H. W. Versey, and W. N. Westlake.
Ex-Officio Members of the Committee.—The President, the Vice-President, and the Hon. Secretary for the time being of the Association.
Representative on the General Committee in place of the one retiring by Rotation.—Mr. F. Blackburn.
Representatives on the District Education Committee of the Institution of Gas Engineers.—Messrs. R. J. H. Clark, C. Harris, R. Robertson, and W. N. Westlake.

HON. SECRETARY AND HON. AUDITORS.

The PRESIDENT proposed that Mr. Donaldson be asked to continue for another year as Hon. Secretary of the Association. The Association were, he said, extraordinarily lucky in their Secretaries.

Mr. W. E. DEAN seconded this, and it was heartily agreed to.

The Hon. Auditors (Messrs. James Donaldson and John Urquhart) were also re-appointed, on the proposition of Mr. J. W. WHIMSTER, seconded by Mr. J. TAYLOR.

NEW MEMBERS.

The following new members were elected: Messrs. G. S. Coburn, Winchester; R. C. Taylor, Portsmouth; V. Simmonds, Vauxhall; A. D. L. Copp, Exeter; E. V. Dunn, Minehead; G. W. G. Tatam, Croydon; W. R. Branson, Staines; and R. F. Rew, Devon Gas Association.

PRESENTATION OF CERTIFICATES.

The PRESIDENT then presented the certificates to the following successful candidates in the Higher Grade Examinations in Gas Engineering and Gas Supply of the Institution of Gas Engineers:

Gas Engineering.

W. L. Ashman, Bath	1st Class
L. F. Garner, Luton	" "
E. H. Hart, Romford	" "
J. A. Marwick, Portsmouth	" "
J. Summerson, Luton	" "
V. J. Borrett, Trowbridge	2nd Class
R. De Gruchy, Kingston-on-Thames	" "
J. Law, Winsham Grove, S.W.	" "
H. Maycock, Sittingbourne	" "
K. C. Mead, Goodmayes	" "
J. D. Stothart, Blenharne Road, S.W.	" "

Gas Supply.

A. H. Castell, Lewisham, S.E.	1st Class
D. J. Davies, Leigham Vale, S.W.	" "
J. S. Hall, Stroud Green Road, N.	" "
R. M. Hilliard, Ruislip	" "
G. H. W. Madge, Stile Hall Gardens, W.	" "
J. Mitchell, Pountney Road, S.W.	" "
A. C. Phillips, Upper Norwood, S.E.	" "
J. Price, Cranwich Road, N.	" "
N. G. Scott, Ewelme Road, S.E.	" " (W.D.)
R. J. Willsmer, Carlisle Square, Chelsea	" "
M. H. Tapper, Bromley	2nd Class
A. J. Toop, Harvest Road, N.W.	" "
P. R. Weichardt, Honor Oak Road, S.E.	" "

INSTITUTION BENEVOLENT FUND.

The PRESIDENT said he now had to make an appeal to the members. The majority of people who worked with them had not to think a very great deal about their futures; but there were some who, not being in this fortunate position, might, and did, fall upon evil days. He begged them all to see what they could do themselves, and to urge others to do the same, for the Benevolent Fund of the Institution of Gas Engineers. Mr. Valon Bennett had gone to a great deal of trouble in trying to collect money, but there were still many who gave nothing. A fund of adequate dimensions should be maintained by the industry, for the benefit of those who needed help.

Mr. C. VALON BENNETT, on behalf of the Management Committee, thanked the President for his remarks, and the Presidents of the other District Associations, also, for the appeals they had made in connection with the Fund. He thanked the Technical Press, too, for the space they had given in advocacy of the fund. These efforts had borne fruit, but he hoped for still further response. Many of them worked for undertakings which had superannuation and widows' and orphans' pension funds; but unfortunately there were many more undertakings which offered no such advantages. He need not remind them of the terrible circumstances in which many people found themselves when the bread-winner was taken away. Heart-breaking cases came before the Committee, who were not able to do all they would like to. He had taken it upon himself, on behalf of the Management Committee, to try and raise more money; and he would tell them what had happened, though really he felt rather ashamed of it. At the beginning of October he sent out 748 letters, but only 160 people had replied, and 135 had subscribed. The total amount of money he had

raised was £88 11s. 6d. He realized that all the members of that Association were not members of the Institution of Gas Engineers; but there were 150 members of the Association who did not contribute one penny towards the Fund, and of this he thought they had no need to feel proud. Each one of his letters of appeal was accompanied by a stamped addressed envelope. The Management Committee could not afford to send out reminders to those people who had not replied; so, unless the stamps had been utilized for some other purpose, he would be glad to receive an answer of some kind. At the time when he presided over that Association, he finished his address with a quotation which he made no apology for repeating now: "I expect to pass through this world but once. If there is any good thing which I can do, or any kindness I can show my fellow man, let me do it now. Let me not defer or neglect it, for I shall not pass this way again."

Losses by Death.

The President referred to recent losses by death, mentioning Mr. Samuel Glover, Mr. C. S. Ellery, and Mr. T. H. Martin; and, as a mark of respect, the members stood in silence.

The Paper.

The President went on to remark that an old friend of his—a man with whom he had worked for many years in the greatest harmony—had consented to read a paper, and he only hoped the members would enjoy it as much as he himself had done on reading it.

Gas Supply in Foreign Parts and Multi-Part Tariffs.

By George Evetts, M.Inst.C.E., M.Cons.E.

An author must first express his appreciation of the great honour which your President has conferred upon him when extending an invitation to address this meeting. The invitation was accepted with a certain amount of hesitation in view of the high standard always attained in your technical contributions.

It is difficult to find a suitable title for the subject matter of this address, but the matter has been introduced at the suggestion of the President, who is fully aware of the author's experience in North and South America, the West Indies, India, and a half a dozen continental countries; differences between gas practice at home and abroad have frequently been the topic of interesting discussions. In view of this experience, it should surely not be difficult to find enough matter to engage your attention for a short session; but the difficulty is, not what to include, but what to omit.

In dealing somewhat sketchily with certain aspects of gas affairs in many countries, the author proposes as a closing theme, a matter which has occupied a prominent position in North American gas politics for the past eight years, and is receiving attention in other parts of the world—viz., multi-part tariffs. The present time is not inopportune for a review of this important subject, and the author has met in all parts with a demand for some form of marketing which will enable gas to meet competition, by getting down closer to the real fuel value.

Sale of Gas.

At this stage a useful table can be introduced showing the amount of gas sold per consumer and per head of population in different parts of the world. It will be understood that these figures are only approximate, and when calculated per head of population the basis is open to criticism, because the population may be taken as the total population of a town or country, or alternatively that portion served by a gas undertaking. The figures are, however, useful, in so far as they show the very good sale per consumer in certain foreign parts, and in North America a very good sale per head of population, but elsewhere a low figure due to the fact that gas only reaches a small proportion of the people.

Exclusive of Public Lighting.

—	Sale per Consumer.	Sale per Head of Population.
	C.Ft.	C Ft.
England and Wales	31,800	8,000
Scotland	25,300	..
London and suburbs	36,000	10,000
Glasgow	26,300	5,400
Birmingham	56,000	12,500
Buenos Aires	28,000	800
Calcutta	69,300	..
Bombay	34,300	..

The following may include public lighting, but figures are not definite:

—	Sale per Consumer.	Sale per Head of Population.
	C.Ft.	C.Ft.
New York	45,000	12,000
Chicago	42,000	10,800
San Francisco	46,000	12,500
Toronto	35,000	9,000
Rio de Janeiro	67,000	1,400
Santiago	50,000	1,050
Montevideo	36,000	750
Bucharest	16,900	160
Bucharest, including public lighting	38,000	350
Stockholm	18,000	4,800
Cape Town	34,500	..
Germany (on basis of population in gas supply areas)	..	3,500
Frankfort	23,000	5,900
Lille	19,000	2,800
Brussels	16,400	4,100
Amsterdam	20,700	4,700
Group of 9 French towns (average population, 500,000)	11,000 to 16,000	..
Group of small French towns	10,700	2,900

North America.

It must not be forgotten that the Gas Industry in the United States of America is on a much greater scale, and is different from the Industry in England, in exactly the same manner as the country as a whole is different. Towns are newer, things are on a larger scale, and, growth being faster, there is not the need for the long physical life of plant which is called for at home. There is also a wider margin between production cost and selling price than there is in this country, and there is also a wider margin between the cost of living and wages. There is thus more money available for luxuries; semi-luxuries to us are necessities to them. As a result of this, gas in American cities is higher in price than in England, flat rates of one-and-a-half dollars per 1000 c.ft. in medium sized cities being common. The flat rate in New York is higher than London.

The Americans advertise gas as skilfully as other commodities, and in spite of additional business being obtained, there is little doubt that service, propaganda, management, and such like is at a higher cost ratio than at home.

In view of the growth of the apartment block system, and the high cost of domestic service, the seller of gas starts with the advantage of being able to show bigger financial inducements in regard to savings in space and labour. In most American cities peak loads bear a higher ratio than the average in this country. For this and other economic reasons we find water gas more popular than in this country.

The vertical retort is not making so much progress as it would in a country a little freer from the water gas "complex." Ovens are more common in gas-works than in this country. In one of the South American towns in which the writer was engaged, water gas was suggested by an expert from the U.S.A. as a substitute for vertical retorts, when the economic position was overwhelmingly in favour of the latter—so much so that coke could have dropped by more than 10s. a ton before the two gases became equal in cost up to holder inlet.

Other things striking the observer making a rapid tour are the multitude of labour-saving devices for coal and coke handling, the number of tankless gasholders, the "Roots" or "Connersville" type of meter and exhauster, and the growth of natural gas supply, this gas being carried very long distances at very high pressures.

The layout of the towns enables the districts to be sectionalized, and one of the modern methods is to deal with sections 1 to 1¼ miles square, feeding each section through reducing governors by a high-pressure main.

All meters are read once a month. No appliances are hired. Hire purchase by twelve monthly payments is almost universal. Prepayment meters are practically non-existent. The sliding-scale system has never been popular. The Boston Consolidated Gas Company introduced it many years ago, and it is believed had it in operation for some years, but have since abandoned it.

The Canadian gas-works visited were very little, if any, less efficient than undertakings of a similar size in the U.S.A.

Steam and Hot Water Supply.

You are probably aware that in New York and other cities steam is distributed through the streets in the same way as gas and water, although the magnitude of the business may not be appreciated. For example, in Detroit the area served is 2½ miles long by 1 mile wide. Some 27 miles of pipe ranging from 4 in. to 20 in. in diameter serve 2000 consumers. The sale is measured by condensation meters, 7 lbs. of steam are sold per lb. of fuel burnt, and the tariff is about 5s. per 1000 lbs. The capital expenditure is more than ten million dollars. The annual revenue is two-and-a-quarter million dollars and the leakage 18 p.ct.

In another town hot water is circulated for heating apartments, hotels, &c. In this, the capital expenditure amounts to one-and-a-quarter million dollars. A total of 35 miles of main, varying in diameter from 1½ in. to 20 in., supply nearly 800 customers whose average bill is 600 dollars per annum. The revenue is therefore about 480,000 dollars, and the profit nearly 140,000 dollars. The most interesting point about this supply is the method of calculating the rental. The rate for the first

500 sq.ft. of radiation surface varies from 55 cents per sq.ft. on a sliding scale down to 38 cents for amounts over 5000 sq.ft. This charge is for the whole season of about 9 months, and the theoretical surface is calculated as follows:

(*a*) Number of square feet of unexposed walls, *less* window and door openings, divided by a wall constant varying from 1 to 8, depending on the thickness of the wall between $\frac{7}{8}$ in. and 27 in.

Plus (*b*) The area of the door and window openings in exposed walls multiplied by 7·5.

Plus (*c*) The contents in cubic feet multiplied by a temperature constant varying from 0·005 to 0·009, according to the temperature guaranteed by the suppliers, which may vary from 50° to 75° Fahr.

The room temperature must not be less than 70°, and a garage or store not less than 50°. The Company are not compelled to furnish a service unless the installed surface is equal to at least 90 p.ct. of the theoretical. Working on these figures it would appear that six rooms (say) 20 ft. by 15 ft. by 12 ft., with one exposed side and one window *plus* passages, would produce the average customer of 600 dollars per annum, and each room would cost an average of 1s. 3d. per day of 24 hours. Against such a tariff as this, the therm or the two-part gas tariff seems simplicity itself.

The writer had the pleasure of attending the annual convention of the American Gas Association in Atlantic City in 1926, where 2500 gas men congregated to listen to papers in all branches of engineering, chemistry, accounting, and administration, and to visit an exhibition of everything up-to-date in the manufacture, distribution, and application of gas for all purposes. One undertaking alone paid the expenses of over 50 delegates to attend this meeting.

Another useful feature is the General Session, in which the industry is lectured *at* by the outside public. Professors of economics, large industrial users, politicians, and such like come to tell the gas men exactly what they think about their methods of doing business, and the virtues and deficiencies of the commodity and the executive side. The Public Relations section has for its object the focussing of gas matters in the public eye, and the education of appropriate Government or Municipal departments on the position and needs of the Gas Industry. There are many useful lessons which can be learnt from the organization of this Association, which is all embracing, and covers the function not only of our parent and subsidiary Institutions of Gas Engineers, but the other bodies as well.

The introduction of gas contractors into the Institution of Gas Engineers is a good sign, and it appears desirable to have still closer co-operation between the Institution and the Society of British Gas Industries and its individual members.

Gas exhibitions in this country are few and far between. It is a pity that one cannot be arranged (say) every five years. The American Association is always five years ahead with its scheme of development, and any paper or line of investigation is part of the co-ordinated programme.

A further attractive feature is the annual presentation of medals to all workers, whether members of the Association or not, who have been instrumental in saving life during the previous twelve months. As may be imagined, these are very highly valued.

South America.

It is often forgotten that there are two of the largest towns in the world in the southern half of the Continent—Buenos Aires with 2 million population and Rio de Janeiro with $1\frac{1}{2}$ millions, both figures including the suburbs. There are, in addition, San Paulo with nearly one million, Montevideo, Santiago, and others with populations of a little under or a little over half a million.

In comparing North and South America, the variation in the native and immigrant stock must not be overlooked, resulting in different characteristics, and a warmer climate resulting in different habits. When it is remembered that the colonists of South America are Spaniards, Portuguese, and latterly many Italians, it is not surprising that the charcoal brazier habit is difficult to eradicate, with a resultant lower sale of gas per head of population. It will be seen, however, that the sale of gas per consumer is exceptionally good. In towns such as Rio and San Paulo, gas is easy to sell; no great expense on propaganda is necessary, whereas in Buenos Aires and Montevideo extensive propaganda is necessary.

Buenos Aires is one of the best markets in the world, with a choice of the produce of Europe, North America, and the East. For machinery there is probably no place in the world with a greater choice. Coal is available from Europe and North America at not too high a price. Oil is imported as well as being found in the country. The startling thing is that gas as a fuel is competing with Cardiff coal and crude oil at about one-fifteenth of the cost per therm of effective use, and with charcoal at a quarter to a fifth of the price. Fortunately, electricity is 50 to 100 p.ct. dearer than gas, depending on the use to which it is put. The present price of gas is approximately 9s. 4d. per 1000 c.ft. for domestic consumers.

The present Company operating in Buenos Aires is the result of three undertakings amalgamating, which orginally competed in certain districts. The result is there are 1200 miles of mains, but only 700 miles of piped streets. The streets lighting load which amounted to one thousand million c.ft. per annum was lost in 1914. It speaks well for the inherent advantage of gas as a fuel that it has made such headway that by 1931 the sale for 1914 will have been overtaken in spite of the loss of the street lighting mentioned above, a loss larger than the total sale of gas in the Rochester and Chatham Gas Company.

The appliances in South America follow the continental more than the British pattern—small ovens and large hot plates—although there is a small sale of the home patterns among the Britishers, who are usually officials of British Companies, and who congregate in certain selected suburbs.

There is a bye-product problem exactly as at home with the added complication that large towns are few and far between, resulting in comparatively small quantities of coke being sent from town to town. The present problem is the development of coke at the same time as gas.

With regard to tar, the chemical works of the gas undertaking is the principal supplier of sheep dip in the Argentine, but there is a limitation in the demand for pitch. The sulphate of ammonia market is threatened from the land side by Chilian nitrate and from the sea by synthetic ammonia.

In South America, as in the North, the slot meter is not favoured. The householder to whom the slot meter would be attractive is usually not a gas consumer, and in many cases the terms of the concession prevent the surcharge necessary to obtain an economical rent for the installation.

With regard to works and efficiency of manufacture, many of those in South America are equal to works of a similar size at home. The plant is of the latest, having regard to the scale of operations, and the chemical control and recording apparatus is completely adequate. In Buenos Aires, for example, the standard of calorific value is 4500 calories per cub.m. (506 B.Th.U.), and the variation is not more than 30 calories ($3\frac{1}{2}$ B.Th.U.), the gas being a mixture of vertical and water gas and sometimes horizontal. The yields of gas and residual products are of a high order.

With regard to distribution in Buenos Aires, there is very little high-pressure work, although a certain amount of boosting is carried on, and district gasholders are a feature. The modern roads in the town make main laying very expensive, with the result that it has become the practice to put mains under both footways.

The gas and electricity undertakings are frequently under the same control, or internally connected, although not to such an extent as in U.S.A.

The problem of tariffs is being considered in South America as a fighting weapon against other forms of fuel, and not necessarily in relation to adequate charge as between one consumer and another.

India.

It is really a misnomer to refer to Indian gas affairs, because there are only two works in the peninsula—viz., Bombay and Calcutta—both of which the author has visited.

It is not surprising in view of the fact that these towns are 1200 miles apart, to find many problems peculiar to each. For instance, Bombay contains a larger proportion of British residents. Broadly speaking, its prosperity depends on shipping and cotton, shipping in turn being dependent on the prosperity of cotton and agriculture. Calcutta depends to some extent on shipping, but principally on the jute and tea trades. Both are, of course, important as general commercial centres, Calcutta more so on account of it being the capital town for business purposes. At the same time there are many similarities between these two towns. In both towns practically the whole of the public lighting is by gas, except certain sections of the principal streets in the centre of the town. The result is that Bombay sells nearly 45 p.ct. of its gas for public lighting and Calcutta nearly 47 p.ct. Here are cases where theoretical costing applied to a public lighting tariff, has to some extent to give way to political considerations. Two curious anomalies appear in the records of the Companies. Calcutta sells double the amount per consumer, but 40 p.ct. less per mile of main. Calcutta being nearer to the collieries is in a position to buy coal cheaper than Bombay where the coal is brought 800 miles. On the other hand, Bombay obtains a greater percentage of return for residual products in relation to the original cost of the coal.

It will be realized that in these hot countries it is very difficult to sell gas for private lighting, although in Bombay there are a large number of small shopkeepers with one or two burners and three-light meters. The great field for gas in India is for hotels, restaurants, biscuit-making, metal-melting, and similar industrial uses, and for cooking and hot water on the domestic side. The geyser is favoured more than the storage heater. Hot water is required quickly with the result that there is an appreciable morning and evening load due to the geyser business. In Calcutta, for instance, one block of ten flats with a frontage of less than 60 yards contains ten cookers

and thirty geysers, and the consumption from these ten consumers averages 75,000 c.ft. The geyser and the cooker load together are useful, but the geyser by itself is not advantageous. For instance, one geyser with a concentrated load contributes 6 rupees revenue a month; add the cooker, and the revenue becomes 25 rupees.

The better class Hindu is taking to hot water for bathing as well as favouring gas cooking, and a large business is anticipated in the future.

Both towns mentioned suffer from competition of coke, made not only in up-to-date coke ovens but in the crudest type of clamps. Bombay has a method of disposal of coke and tar to tendering contractors. These contractors can get to markets of which the Company know nothing. Both tar and coke are sent up country, and in the town itself an anna's worth of coke (about 1d.) can be purchased. There is the usual competition between tar and bitumen, and a tar-bitumen mixture has been successfully experimented with.

Rumania.

Coming nearer home, the author has had the opportunity of investigating a natural gas system in Rumania as well as the manufactured gas undertaking in Bucharest. There is little of interest in Bucharest, the chief point being a gradual decrease in the sale and no apparent effort to go out for new business.

In Bucharest there are 9000 consumers taking 16,500 c.ft. of gas per annum and 7200 public lamps each taking 17,500 c.ft. per annum, and the price of gas is the equivalent of 4s. 10d. per 1000 c.ft. Electricity is practically 3d. a unit.

With regard to the natural gas system, the author found a most interesting state of affairs. Gas is of the "wet" variety —*i.e.*, it comes up with the oil. It is collected from various wells, some used for compression at the well head, some used in boilers, and has a gasolene extracted at the well head, and the whole surplus is then collected and sent about 35 miles distant. Gasolene is deposited in syphons *en route*, and the gas is treated for gasolene in an activated carbon plant, the calorific value of the stripped gas being about 1100 B.Th.U. per c.ft. The gas so treated is then used for the public supply of the town, and the surplus is used in boilers at the oil refineries. The daily capacity of the pipe line is about 5·6 million c.ft., and up to the present the maximum quantity brought down is nearly 5 millions.

A curious feature about this supply is that there is no storage. An allied undertaking takes the surplus for boilers in lieu of fuel oil at an hour's notice. There is a connection in the town from an outside supplier, which puts gas into the street mains when the pressure falls below a predetermined amount, and by these two means the load factor has been met up to the present without wasting more than about 3 p.ct. of the total gas. Calculation shows at present that the avoidable waste is worth less than the interest, repairs, and depreciation of a gasholder.

In this town (less than 40 miles from Bucharest) the author found the cheapest gas in the world—viz., 14·5d. per 1000 c.ft. of 1100 B.Th.U. gas—*i.e.*, barely 1·3d. per therm, and gas for industrial purposes is less than half this price. Therefore we have the startling difference between two towns less than 40 miles apart in which gas in the larger town is 9 times the price of the smaller on the thermal basis. Even if the surplus gas is practically valueless, yet the capital, distribution, and administration costs make this price a very fine performance; it is only about 30 p.ct. more than fuel oil, and less than half the price of wood. Even in this town, however, the author was asked to advise on a variable tariff to attract the large industrial consumer. Although the undertaking has been going for less than two years, there are about 1600 consumers, and the domestic consumers take on an average about 35,000 c.ft. of this rich gas, equivalent to about 80,000 c.ft. per annum of 480 gas.

France, Germany, and Belgium.

There are many interesting points in the gas supply of these three countries, but time forbids more than a short reference. There are many variations in carbonizing, with horizontal retorts and chambers, vertical retorts, and gasification systems for coal and coke.

In Germany, the Ruhr scheme with its large network of mains, enormous compressors, and frequency of waterless holders are features of interest to the visitor. Probably in Germany the gasification of coal and the treatment of bye-products in coke ovens is more to the front than the gas-works proper, but this is probaly merely a phase due to post-war industrial development in Germany. Incidentally, during a tour the author was struck with the almost universal adoption of rubber bands for conveying warm coke, and at one cokery he found a waste-heat boiler fitted to each ascension pipe, and figures were given to show that the installation paid for itself within one year.

The author is interested in a plant in Belgium, which will have one or two unusual features. To begin with, it is the first cokery within the author's knowledge functioning purely as a gas-works, and it is also the most important supplier of gas to a grid system comprising 20-in. mains. A site which two years ago was meadow will in twelve months be making about 20 millions of gas a day by coke ovens and producers for supply to a grid.

An interesting feature of this work is a set of purifiers 36 ft. by 33 ft. by 16 ft. deep dealing with 14 million c.ft. of gas per day, with air blowing plant for revivification in the box, and it is expected that the oxide will be fully fouled with one charging.

These works in themselves would form a topic for one session of any technical institution, but time forbids further reference.

Multi-part Tariffs.

There is one outstanding point in all the gas undertakings visited, and that is the desire for a form of tariff designed to attract new business and meet the increased competition of other forms of fuel.

In the United States the subject has been closely studied for nearly ten years, and the matter has been viewed from every angle. It was first recognized that gas is an ideal fuel for many purposes for which it was prohibitive in price when based on the then standard method of selling—viz., a flat rate with a discount, either fixed or on a sliding scale. A further examination showed that gas could be sold at a low price, providing certain standing charges were met, and that a development of sales at this low price would not injure the existing consumers. The next step was the realization that as between certain groups of existing consumers there were startling anomalies, and in order to do the good consumer justice, the unprofitable one should be made to bear his fair burden. The more he uses the commodity the cheaper should it become viewed either commercially or scientifically, and it was further shown that the unprofitable consumer was in most cases not the poor man.

A parallel which comes to mind is the possession of a motor car, which the owner has to garage. With a 14-h.p. car the total cost per annum may easily reach £50 before the wheels turn round. Leaving depreciation out of the question, petrol, oil, tyres, and minor repairs may cost 1½d. a mile. For a motorist doing only 1000 miles per year, the total flat rate cost works out at 1s. 1½d. a mile, but for 12,000 it is only 2½d. a mile, probably a record case of a "discount" for taking a quantity.

Expressed as a two-part tariff, the service charge is £50 a year and the commodity costs 1½d. a mile.

After having worked for so long on the flat-rate system, the Americans naturally found it difficult to change. As in the case of the "therm" in this country, the consumer imagined there was a catch in it to make him pay more. In the States the gas and similar industries are controlled in each State by "Public Utility Commissioners," and before a change can be made in the method of charge, the proposed rate has to be filed with the Commissioners, and objectors can be heard at a public inquiry exactly as in this country. However, as time went on the Commissioners began to see the wisdom and equity of the new method, and as they learned the effects of the earlier experiments, they became enthusiasts, and in one State it was affirmed that the multi-part rate is the only sound method of charging, and the flat rate was condemned.

You will see this decision in the appendix to the National Gas Council Report of November, 1927, and in the October report of that year is published a considered opinion of the Standing Committee of the National Association of Public Utility Commissioners which is worth reading. The expression of their approval is in the following significant words "so as to permit the Gas Industry to develop its maximum possibilities in more extensive and more economical service to the public." Do not forget that these Commissioners are like our Board of Trade and Parliamentary Committees, the guardians of the public.

Seeing that the question of multi-part tariffs is prominent at the present time, it is desirable to consider the matter in the following stages:

(1) Is the present charge equitable as between different groups of consumers and between individual consumers in the same group?

(2) Is the present method preventing the development of your undertaking in the best manner?

(3) In the event of the answer to Question 1 being in the negative, would a more logical and scientific system be desirable as a matter of policy?

(4) In the event of a change being contemplated, what are the fundamental considerations involved in framing a new form of tariff?

The subject is so vast that it is impossible to deal with its ramifications in a short address, but it will be useful to deal briefly with the four stages above outlined.

(1) *The Equity of the Flat Rate System.*—There can be very few who will agree that the flat rate system is fair. The old trading demand for a reduction for "taking a quantity" must be satisfied, and most undertakings give discounts either for quantities or for gas used for certain purposes. Even the trades chosen for discounts usually imply the consumption of

quantities in excess of the domestic consumer. Any scale of discounts or rebates put into operation (apart from discounts for prompt payment) is an admission of the principle that every thousand cubic feet of gas does not involve an equal charge on the undertaking.

Having admitted the principle the further question to be answered is, Does the scale of discounts fully compensate for the difference in actual cost to the undertaking of the various consumers? If not, then these charges are still unfair.

An investigation into the costs will satisfy most of you that the discount system is not sufficient to provide the necessary differentiation, and, therefore, the answer to query number 1 is "No," with the consequential result that some consumers are subsidizing others. In fact, we can go further, and say that some consumers are being supplied at a loss, and a proportion of these at such a rate of loss that the undertaking in question would be better off without them.

This surely is not a healthy condition for a competitive industry. In some Government and non-trading Municipal enterprises, we have to accept this position of affairs because it forms a useful system for administrative and commercial purposes, and ability to pay may be the basis of charge as well as services rendered. Even in different branches of the same Government trading department, however, the principle varies. The Post Office carries a letter for a common charge independent of distance, but trunk calls on the telephone vary with the distance, and for local calls the tariff is built up on a two-part charge, one element of which is a fixed minimum contribution. Therefore, if we are prepared to operate on a commercial basis, a variable charge appears to be logical as well as economic.

(2) *Does the Flat Rate Hinder Development?*—This question is more difficult to answer, because the results of such hindrance would not always be positive, but at least we can say that it does not assist development. In certain districts of a purely residential character it might be easy to argue that a two-part tariff would not assist, but this would be purely an expression of opinion, and not backed up by experience. The fact is that, even in a residential district, there is no incentive to increase the consumption. Ask Halifax and Todmorden, where alternative systems have been tried. True, the alternatives at these places are optional, but we are now dealing with the effect of the tariff. Having chosen a tariff which means a lower bill for the *standard* or *existing* rate of consumption, the consumer gradually increases his demand until his annual account is greater than before, because of the psychological effect of the operation of the tariff.

For a district with a large industrial load, potential or existing, there is little doubt that gas is not used as much as its inherent virtues justify.

If a calculation is made of the cost of competitive forms of fuel, we find that

Gas costs (say)	8d.	per therm (unless large discounts are granted)
Coal	1d.	,, (25s. per ton)
Fuel oil	2·8d.	,, (£3 ,,)

It is palpable that in order to sell gas for industrial purposes there must be many incidental advantages and an extremely high efficiency, and it must be of supreme value to get fuel cost more nearly equal to the chief competitors. Naturally the question arises, Why should the finished product cost six to eight times the price of the raw material? The answer, of course, is that the price of the finished product includes service, and that service is sold at too high a price when it becomes merged into the commodity charge.

Therefore, in general terms, the answer to the second query is "Yes."

(3) *Is It Policy to Change the Method of Charge?*—This is, of course, the most difficult question to answer, and each responsible officer must gauge his own position and form his own conclusions. At least this can be said: if the alternative system is optional, no objection can be raised. On the other hand, the optional method does not solve the problem of equating the scientific charge and the consequential elimination of the non-profitable consumer. Regarding consumers who are not even paying the standing charges, is it not better to face the situation and inform them that they can no longer be subsidized by the remainder? After all, most electrical undertakings have a minimum charge which is in the nature of a service charge in so far as it assures a certain revenue to the suppliers.

There is always a best time for a change of this nature, whether optional or not, and that time is when a reduction in revenue can be faced; this excess revenue can be dispersed by reducing the charges to large consumers as a result of the new tariff rate, without increasing it to the others. This is not possible very often, however.

With regard to industrial consumers, it is generally admitted that a correct two or three part charge is an effective weapon to meet competition. To give the large consumer absolutely fair terms (whether industrial or not) the unprofitable consumer must be eliminated.

Before taking a decision, it is desirable to classify the consumers to ascertain the class which will be affected by the change in the system. If the consumer using the smallest quantity is the comfortably off citizen using gas for convenience or emergency purposes, then no hardship is being inflicted on the poor man, and the political opposition then becomes less formidable.

Another consideration which will help to solve this question will be the form of tariff contemplated, in the event of a change. We have the two, three, and four part rate (it is not thought necessary to explain these in view of the publicity which the subject has had recently), also the concealed service charge which comprises a comparatively high charge for the first thousand cubic feet of gas. There is also the minimum charge for any quantity up to a certain amount, which is a familiar system in electrical undertakings.

It will generally be found that the industrial consumer will be able to see the fairness and advantage of the three-part charge, but, for the domestic consumer, some form of two-part charge is likely to be more acceptable, and a two-part charge varying with the size of the service pipe and meter introduces the demand charge in a practical and roughly effective manner.

(4) *Fundamental Considerations in Framing a Multi-part Tariff.*—It is assumed in this address that the necessary legislative obstacles will be overcome, and an undertaking will be free to put any method into operation, providing the average price is within the maximum, or in the case of a sliding-scale or basic company will rule the dividend, and that the system is applicable to all consumers in like circumstances.

The first necessity is to provide a certain revenue to meet the fixed operating expenses, the depreciation (or sinking fund), and the interest on capital and loans, not forgetting that the last is one of the most important elements in the cost of gas and the service supplied.

Next, a certain output must be assumed, and this is naturally taken as equal to the current amount, or such increase as is anticipated in the following period in view of the known conditions. Then the consumers must be carefully grouped with respect to the annual consumption, and the maximum daily demand, and the maximum hourly demand. It is sufficient at first to take the largest consumers individually and the balance in groups.

These figures can then be balanced against the combined maximum day and hour of the whole undertaking, thus obtaining the load and diversity factors. The classification enables an assessment to be made of the effect of any suggested tariff.

Having obtained all the information possible, and divided the costs of the gas and service into the respective elements, there are many other factors to be considered before a tariff can be put into operation, although one may be framed which would give satisfaction to the undertaking.

The acid tests of the tariff are:

(1) Is it equitable as between different consumers?
(2) Does it produce the necessary revenue?
(3) Does it permit of any volume of additional business in large or small elements with proportionately increased prosperity?

If the scheme does not answer the last of these requirements, then it must obviously be commercially unsound, although the scientific tariff may need variation for political reasons.

There will always be practical difficulty in dealing with the unprofitable consumer. First it must be understood what is meant by "unprofitable," and what is the basis of assessment. What is more important, some capital has already been spent on the consumer which is not recoverable, and it may be preferable, and better financially and politically, to have certain consumers on the mains than as derelicts, although new ones of that nature would not be connected up.

It is useful to mention at this point that we must keep in mind the broad division of our cost into gas and service. As a general statement "gas" is the commodity, and "service" corresponds to anything else which goes to make up our expenditure—*i.e.*, the readiness to serve, the attention to complaints and records, and the provision of appliances for measuring and burning.

It will be admitted that there is no justification for selling gas (or service) to a consumer at such a cost that the undertaking as a whole will be worse off with that particular consumer than without him.

It is possible in some cases that the selling price is so low that even the assistance given to the capital and standing charges is more than neutralized by the margin between the known cost of production and the selling price; such business should be refused, or, if in existence, then eliminated. It will not be challenged that gas should never be sold at less than the cost into gasholder *plus* a substantial portion of the capital charges on the works. This statement leads up to the axiom that new consumers should never be given the advantage of capital spent on the existing ones. It is often argued that a new customer should escape capital charges if no new plant is needed, or no new mains. The saving should go towards an all-round reduction when the volume of new business warrants it, not to the newcomer only.

It may be suggested that the undertaking would be better

off with the newcomer than without him; therefore, he must be profitable, but the true test is to take hundreds of prospective customers of such a nature, and then see whether the undertaking would be better off. There is great danger in following this line of argument. For instance, it will be agreed that new consumers taking gas between midnight and 8 a.m. are highly desirable and that some consideration might be offered to attract them; the question is how much? On the works, the load factor over the 24 hours would show no improvement; it is already practically 100 p.ct. On the district we wish to see the valley of the output curve filled in, because the distribution, operating, and capital charges can be reduced to all. Assume that one customer comes along and fills in the valley completely, and is given special terms. Immediately the basis becomes changed, and any consumer offering business to an undertaking with a flat output line is an embarrassment. Another customer may come along offering an exactly similar load to the first, but, rather than give favourable terms, the inclination would be to ask him for more, because he is spoiling the load curve. There is also a danger in giving special terms to a prospective consumer who would use up surplus plant, because that plant should be regarded as available for more profitable business.

Most gas undertakings have the maximum of plant working in the winter and the minimum in summer, and, therefore, an additional summer load is attractive; but it must not be overlooked that there must be a surplus to permit of necessary repairs, and actually a seasonable load factor of 100 p.ct. would be a menace.

If there is surplus plant all the year round, there is no sound reason why a prospective customer should be given special terms in order to utilize that plant unless there is no possible prospect of utilizing it for consumers at the normal price. Further, a 24-hour load, although improving the load factor, does not alter the difference between maximum and minimum output. It only makes that difference a lesser proportion of the whole.

The unfairness of giving the last comer the advantage of capital already expended cannot be over-emphasized. If this system were logical, then any new consumer could claim gas for the net coal figure, because he could prove that no extra expense is involved in giving him a supply except the raw material.

There is another danger of offering special terms for certain loads. Suppose, in order to build up a load, a prospective consumer is offered terms which do not cover the correct proportion of all the costs, but on such terms that the finances of the undertaking are improved. Other consumers could then claim that they are equally valuable for the load curve, and threaten to take their business away unless the same terms are forthcoming.

Therefore, the relative value of new load is continually changing and the actual system would probably consist of a combination of economics and policy, both factors being liable to abrupt changes.

It is perfectly clear that except in the case of very large consumers, the customers must be taken in groups, and in dealing with demand charges, the diversity factor is the most difficult to assess.

The addition of the individual maximum hourly demands will be in excess of the actual maximum hour of the company, and the same for the maximum 24 hours. Some opinions favour the application of a common diversity factor to all groups, whereas others think that the necessary elasticity in the tariff is provided by the application of a varying diversity factor dependent upon the hours and seasons during which gas will be needed.

In framing a tariff care should be taken to deal with all consumers alike who take gas under like circumstances. The discounts should apply to the amount of gas used and the load factor and not to a particular trade as such. We should then avoid anomalies, such as the fish fryer getting an industrial discount when he takes less gas than a good domestic consumer and offers a worse load factor.

After all is said, however, there is no doubt that policy must have some influence in the framing of a tariff, and competition also. It is extremely difficult to lay down rules defining the effect of limitations of policy, but it will not be denied that policy must be ruled primarily by economic considerations, loading the scales heavily in the direction of enterprise. Enterprise is in turn influenced by economics, seeing that it may be defined as advance expenditure for money and brains in the hope of financial reward.

Competition must be considered from two standpoints—getting new business, and retaining old. In the effort to get new business it is reasonable to reduce the price in anticipation of the savings which would accrue if that business matures. When faced with competition which is likely to result in business being lost, then it is economic policy to reduce gas to such a price as would entail less damage than the loss of the business would entail, if there is no alternative business to obtain. If, on the other hand, alternative business can be obtained at more remunerative prices, it would be better policy and better economics to transfer the resources employed from low price sales to higher price sales.

These general remarks do not touch upon the actual framing of a multi-part tariff. The National Gas Council have already given some indication in their report of the lines on which the costs should be allocated. In order to ascertain the correct allocation, it is useful to consider the effect of selling all your gas to one consumer and visualize the effect on your costs. If that particular cost would practically vanish, then the item in question is a customer or service cost. Also, consider the effect of doubling or trebling the amount of gas made; if this increases the item under consideration *pro rata*, then the item is a commodity charge.

In calculating the demand costs, the matter can be ascertained by considering the effect of selling the same amount of gas at double the rate per hour, or alternatively doubling the sale at the same rate per hour (or per day). By thinking on these lines the items are brought into correct focus. Some must always be a matter of compromise, but it will be found that these items will not seriously affect the total result.

In estimating the costs it will be found useful to eliminate the hiring of meters, stoves, and fittings in a preliminary investigation, and then write them back for the purpose of framing the tariff.

For instance, suppose in framing a two-part tariff we find that the customer charge is 30s. a year and the commodity charge 6d. a therm, leaving out meters. On a separate calculation we may calculate that the necessary repairs and interest and sinking fund on meters is as follows:

	s.	d.	
Size No. 1	5	0	per annum
,, ,, 2	7	6	,,
,, ,, 3	10	0	,,

The full customer charge would then be:

s.	d.	
35	0	for No. 1.
37	6	,, ,, 2.
40	0	,, ,, 3.

By a variation in these charges it is simple to include a demand element.

The framing of a tariff suitable for prepayment consumers is very difficult, and will need all the thought which can be given to it. The chief difficulty is in retaining the prepayment principle.

Sufficient has been written to show the fascination and complexity of the problem, and it must be capable of solution. The Americans are now satisfied that they can frame a form of tariff which is equitable, politic, and sufficiently attractive to bring increased business and meet competition.

Discussion.

The PRESIDENT said he would make no reference to matters of opinion, but the facts put forward in the paper might safely be taken as correct. Mr. Evetts had had a unique opportunity of seeing the different works to which he referred under such conditions that he was able to get really on the inside of things.

Mr. C. F. BOTLEY (Hastings) remarked that he was glad to have the opportunity of proposing a hearty vote of thanks to the author, because he and the other members of the Committee with whom he was associated were greatly indebted to Mr. Evetts for assistance he had rendered on this question of tariffs. Those who had read the Gas Charges Committee's report would remember that it contained an acknowledgment of the services of Mr. Evetts, and he (Mr. Botley) personally owed him a great debt of gratitude. There could be scarcely anyone in the room who possessed the unique experience of the author in connection with gas-works in all parts of the world, and he had given them a most interesting picture. Of course, Mr. Evetts had been impressed, as they must all be, with the need in these various countries of having a flexible tariff as compared with a flat rate tariff to meet the conditions of to-day.

STRENGTH OF THE GAS INDUSTRY.

When making inquiries some years ago, he himself had been very much surprised with regard to gas supply in Switzerland. He did not know whether there had since been any change, but the information he obtained at that time was that, although they had to import every ounce of coal, and in spite of the enormous amount of water power available, gas was going ahead. It struck him as being a significant sign of the strength of the gas industry that, in face of the facilities offered by other forms of power, it was found practically everywhere to be flourishing. This showed that there was an inherent advantage in gas supply, which was different from any other kind of fuel. This was a point which it would be useful to bear in mind. With regard to gas charges, the matter contained in Mr. Evetts's paper would enable members to understand to some extent the intricacies of a matter which it had taken the Gas Charges Committee a good many years to get to the bottom of. It was interesting to find the author now putting before them conclusions which he (Mr. Botley) himself had arrived at, and which he had in several cases acted upon. Towards the end of the paper, Mr. Evetts suggested a little form of exercise which, if the members would follow it out, would be a most useful line of examination of the problem. It was an urgent problem in the interests of the gas industry to-day. A two-part tariff offered them a weapon with which to meet, not only competition, but equity as between one consumer and another; and it also offered an inducement to consumers to increase the consumption of gas for all purposes. In America it would be absolutely

impossible, without some such tariff system, to have the gas heating load which was now a part of their business.

Tariffs Equitable and Otherwise.

Mr. F. Livesey (Maidstone) seconded the vote of thanks to the author for his paper on the most important topic that the gas industry had to consider at the present time. One of the acid tests of a tariff, as stated by the author, was: "Is it equitable as between different consumers?" The industry was faced with nothing less than a war against electricity; and it was recognized that much of the success which electricity companies had obtained had been secured by means of their tariffs. In his own town tariffs had been arranged which quite obviously were not equitable, and accountants who had examined them had declared them to be fundamentally wrong; but they had worked, and had brought the business. The charges were, in fact, based on expediency, and not on equity. This, therefore, was what they had to meet, and in formulating a tariff, the chief thing they had to consider was: "Will it work?" Regarding this aspect of the matter, he would like to ask the author if he had any information from American companies who had adopted some such system of tariffs as to whether they had met with very great opposition. He felt that in his own town there would be some. Having now got over the therm difficulty, they would naturally hesitate about trying something else which the public might find trouble in understanding. Their feeling, indeed, was that they would like someone else to try it first.

The End of a Tariff?

Mr. Arthur Valon (London) remarked that the whole of the industry ought to be very grateful indeed to Mr. Evetts for the way in which, although an extremely busy man, he always placed the fruits of his experience before his professional brethren. [Applause.] What he had to say was invariably both interesting and valuable. In the first place, he would like to enter a little protest against the appropriation of the adjective "scientific" to the two-part or multi-part tariff. He presumed in this connection it meant that it was an efficient means to a given end, in which case the end to be obtained became of importance. Now, the end of the two-part or multi-part tariff seemed to be to ensure that every individual consumer should be profitable to the undertaking. That was to say, that the actual cost of supplying every single consumer, together with the interest and dividend upon the capital employed to supply him, should be covered by that consumer. He himself was inclined to deny that this was the end of a tariff. It was not, if one looked at it from the point of view of the shareholder, who was interested in the dividend he received and in the security of that dividend. It was not even the end, he thought, for the consumer himself. The consumer primarily wanted the service which gas would give him, provided that this service was cheaper, taking all things into consideration, than any alternative method. Consequently, the consumer wanted that service at the lowest possible price. There were public considerations, which were many and varied. He thought it was the function of policy to frame a tariff to meet all these ends; and if they did so frame a tariff, it would probably be an artistic tariff, rather than a scientific one.

A Possible Danger.

In so far as the two-part or multi-part tariff was concerned, he did not want it to be thought that he was opposed to it, because he was not. There was no doubt that at the present time they all wanted some means of encouraging people to use gas more freely. With a two-part tariff, they had a service charge and a commodity charge, and a consumer, when he was considering putting in more apparatus, had only to regard the commodity charge. This was undoubtedly an encouragement to him to extend the use of gas. What he did not want to see was the two-part or multi-part tariff adopted so that it would be more rigid than the existing tariffs. At present they had what was called a flat rate. It was not really a flat rate, because they could allow discounts and make special prices for special purposes and for special amounts. This made it possible for them to vary the charges within very wide limits; but he did think that, as an added weapon, the two-part or multi-part tariff was a good thing. The author said that no objection could be raised to it if it was adopted as an alternative. What he thought people were afraid of in adopting it as an alternative was that all those to whom it would mean a reduction would adopt the two-part tariff, and the undertaking would be left with all the other flat-rate consumers, who were better off if they remained so. There remained the difficulty of the sliding-scale, and, in any case, if they were going to apply the two-part tariff, they must get their financial provisions altered. This kind of tariff would be an exceedingly useful thing for the industry, but they must be very careful that it was not substituted for all their other methods of charging, and put upon them as an obligation. Where they had gas being used for a certain purpose, for which they could sell at a higher price and get a larger profit, he denied altogether that they should be bound to keep the price down to that consumer, and to keep it up for another purpose where they must sell at a lower price in order to get the business at all. He did not believe that, properly used, such freedom was against the public interests.

A Complex Problem.

Mr. E. J. Fottrell (Joint Manager of the National Gas Council), called upon by the President, declared that there was no one in this country who knew more than Mr. Evetts about this matter of gas tariffs. Four years ago he himself returned from a visit to the United States, and since that time he had every day been brought in contact with this problem of gas tariffs in one form or another. He could not help feeling that the difficulty to which Mr. Valon had referred—the statutory bar in the way of sliding-scale companies—had been one of the obstacles which had prevented further investigation of the subject in this country; people's judgment had been rather biased by such difficulties as stood in the way of a change. The problem was very complex, and there were undoubtedly obstacles in the way of a change; but he rather feared that for this reason many people had been rather concerned with magnifying the difficulties than with forming a calm and collected judgment on the matter of policy. If once the question of policy was settled, he felt that the overcoming of the difficulties in the way of a change would become progressively less. Most people now understood the two-part tariff; and the three or four part tariff was nothing more than a two-part tariff in which the fixed part was arrived at by a somewhat different process of calculation. At the end of the report of the Committee on Gas Charges there was an appendix to which Mr. Evetts, with his usual modesty, had not referred, but for which he was very largely responsible. Whatever one might feel as to the desirability or otherwise of the change, every engineer ought to study his own working costs upon the lines there indicated. To his own knowledge, people who had done this had been perfectly astounded at the price at which they could, in certain circumstances, afford to sell gas. The sale of gas in the United States for industrial and commercial purposes alone, when compared on a calorific value basis, was ten times the entire output of gas to-day in Great Britain for all purposes.

A Smaller Unit?

Mr. H. C. Smith (Tottenham) said he would like to refer to one matter in connection with charges for gas which did not appear in the paper. The two-part or multi-part tariff was avowedly suggested to combat the sale of electricity. Now, many people had had in their minds for some time—and the matter had lately been ventilated in the Technical Press—that comparison was complicated by the fact that the electrical unit consisted of 3412 B.Th.U., whereas a therm of gas contained 100,000 B.Th.U., and certain proposals had been made for the introduction of a new unit for gas. There were many arguments both for and against such a course; but if one considered the position of the gas salesman, who was primarily responsible for increasing the number of appliances in a consumer's house, one would see how much easier his task would be if he were able to answer a consumer who remarked: "I only pay 1d. per unit for electricity," by saying: "You will only pay 0·25d. per unit for gas." From this point of view alone, he thought the question of the size of the unit adopted for the sale of gas was well worthy of consideration, and this should be done at once. They had seen from the Technical Press that one or two undertakings had already decided to adopt a smaller unit, and if the matter were treated in this way they might have different units. He thought, therefore, they should ask the National Gas Council to consider the subject immediately because if there was anything in it they should be careful to have the right unit. If a smaller unit was desirable, the National Gas Council should agree upon the correct figure to adopt.

Mr. Botley replied that the Gas Charges Committee were taking this matter into consideration. Meanwhile, he did hope that the industry would not be led into a side avenue by establishing a fresh unit, especially if it meant altering the calorific value to 511·8. To-day comparisons were simple. If with electricity one got 3412 B.Th.U. for a penny, the salesman could very soon put forward for comparison the number of B.Th.U. there would be in a penny-worth of gas.

Mr. W. H. Bennett (Redhill), referring to the 1100 B.Th.U. gas in Roumania, asked whether any difficulty was experienced with mantles sooting up.

What Bath is Doing.

Mr. J. W. Whimster (Bath) said he was a little disappointed, because he had hoped the author would give them an example of the working of the four-part tariff from an imaginary gas company's accounts. He had always looked upon it as being very complicated. Personally, he regarded with favour the block system tariff, having the highest price up to a certain consumption, and this price being gradually lowered in blocks, so that the big consumer got an additional advantage. He suggested to members that it would be interesting to analyze their gas consumption figures. In his own case, although 25 p.ct. of the ordinary consumers were under 20,000 c.ft., yet the average consumption of ordinary consumers was of the order of 75,000 c.ft., and the average of all consumers was round about 56,000 c.ft. The author showed Birmingham as having apparently the highest sales per consumer in the British Isles. In 1929 the figures in therms were: Birmingham, 258; Bath, 267. The sale per head of population was shown in the paper as 12,500 c.ft. in the case of Birmingham. In Bath it was over 15,000 c.ft. Birmingham had always been very high in sales per consumer. In 1914 the figure was 52,000 c.ft. for Birmingham, whereas for Bath it was 38,000 c.ft. In Bath there had been very little house building since the war; but over a certain period with an increase of 18 p.ct. in population there had been an increase of 55 p.ct. in the consumption of gas.

Position of Slot Consumers.

Mr. F. Porteous (Ware) inquired about America and the prepayment system, saying there was no mention of this in the Gas Charges Committee's report. The author had, however, mentioned in the paper that the framing of a tariff suitable for prepayment consumers was very difficult. In his own town, he had in crude form a two-part tariff for slots. They had 14 c.ft. for a penny up to 5000 c.ft. a quarter, and 18 c.ft. for a penny for all above that. The slot rate was 1s. 5d. per 1000 c.ft. extra up to 5000 c.ft. This gave 7s., which was considered an adequate return for rent of meter, cooker, &c. On all consumption above 5000 c.ft., they returned the difference between the slot rate and the ordinary rate—that was, 1s. 5d. per 1000 c.ft. On a consumption of 6000 c.ft., the collector handed back 1s. 5d., and so on. This system had been found to be very effective.

Reply by the Author.

Mr. Evetts, in the course of his reply to points that had been raised in the discussion, said that one could not go over to the United States and look into this question of gas tariffs without

coming back a firm advocate of the system. The American people had dealt with the matter in a thoroughly practical manner. In using the word "scientific," he had meant as near to exactness as one could get. The fixing of an exact form of tariff calculated on a strict accounting charge would be difficult; but the Americans had got very close to it. The more consumers they got as the result of this tariff, the greater was the profit they could show; and that was the acid test for a practical tariff, as compared with an accurate one.

The author said it seemed to him that some of the electrical tariffs were dangerous to the undertakings themselves. They could not stand having thousands of consumers put on their mains at some of the tariffs they were offering. And this led up to another point in discussing gas tariffs. They must not allow expediency to go too far. He did not intend his paper to contain dogmatic statements so much as pointers. The Americans experienced enormous opposition to the proposal at first. The National Gas Council were not so much asking the British gas industry to swallow their form of tariff, as to so agitate that they would get the power to put a tariff into operation. They could not expect the National Gas Council to strive to obtain something for them, unless they showed themselves definitely interested in it. They must first of all decide whether they wanted it. He was glad that Mr. Valon had pointed to some of the difficulties. Mr. W. B. McLusky, of Halifax, was thoroughly pleased with his increased consumption, even by using an optional tariff, which everyone who would save anything could adopt, and everyone who would not save could leave alone. He had not had to put up the price of gas to anybody.

He agreed that the question of the size of the gas unit required very careful consideration. The difficulty was that in selecting a small unit such as that in mind they would be bound to introduce decimal points. It was easy at present for the salesman to take out comparative figures, and it had always been a matter of astonishment to him (Mr. Evetts) that there was not shown on every appliance in a showroom the cost per hour to run at the calorific value supplied and the price. As there was no gas lighting in Roumania, there were no mantles employed. In view of the example given by the National Gas Council, it was not really necessary for him to work out a four-part tariff. There were no slot meters in America.

While referring to slot meters, Mr. Evetts said it seemed strange to him that undertakings had always refused to give slot consumers a fire. He thought they could do considerably better with prepayment meter users by giving them more encouragement to use gas which was supplied to them at the highest price. The figures of gas consumption given by him in the table in the earlier part of his paper he had intended to be merely typical.

Vote of Thanks to the President.

Mr. T. Carmichael proposed a hearty vote of thanks to their popular President for all that he had done for the Southern Association in particular and for the gas industry in general.

Mr. C. H. Rutter seconded the vote, which was carried with acclamation.

The President, in acknowledgment, said that when he was asked to be Vice-President he knew it meant a year of office, and at first he felt a little nervous, but it had been very pleasant. He had learned a great deal, and he had made many friends whom he might not otherwise have met.

London and Southern District Junior Gas Association

Mr. J. M. Webber on Electrical Plant on Gas-Works

A Meeting of the London and Southern District Junior Gas Association was held at the Westminster Technical Institute on Friday, Nov. 21.—Mr. T. H. Prater, the President, in the chair.

The Hon. Assistant Secretary (Mr. G. Gardiner, Wandsworth) read the minutes of the last general meeting.

The President then referred to the death of one of the oldest of their members—Mr. G. Cox, of the South Metropolitan Gas Company—and called upon those present to stand in silence for a moment in respect to his memory.

The inscribed silver salver which was to have been presented to the Association's retiring Auditor, Mr. E. G. Merry, of the Gas Light and Coke Company, at the last meeting, but was not presented on account of Mr. Merry's absence through illness, was presented on this occasion by the President, who paid nigh tribute to Mr. Merry's work as Auditor of the London and Southern District Junior Gas Association from 1906 to 1930.

Mr. Merry, in returning thanks for the presentation, said that when he first took up the work it was very light, but as the Association grew so the work increased. It had been a great pleasure, said Mr. Merry, and his reason for resigning was that he had just completed 40 years with his Company, and he would be retiring shortly.

The President then welcomed a number of new members to the Association, after which he called upon Mr. Webber to read his paper.

The photographs reproduced of electrical plant at Croydon were taken by Mr. F. J. Harrison, Chief Draughtsman of the Gas Company.

ELECTRICAL PLANT AS APPLIED TO GAS-WORKS.

By J. M. Webber, of the Croydon Gas Company.

Electricity is used so widely in gas-works to-day that it is impossible to refer to all the plant involved in a paper such as this. Gas engineers are devoting a great deal of attention to the cheap generation of current and its efficient use, and it was felt that this paper might be of more practical value if it was devoted entirely to the latter subject rather than attempt to deal with both in the short time available.

Selection of Motors.

The selection of a suitable motor for a given duty is not a difficult matter, provided that certain conditions are known beforehand, and care in this respect will be amply repaid afterwards by efficient operation and freedom from trouble.

Assuming that it is decided to drive a certain plant by an electric motor, what information is required in order to specify the best type for the purpose? The following are some of the most important points:

(1) Nature and voltage of electricity supply.
(2) Estimated H.P. required at the motor shaft.
(3) Starting torque required.
(4) Nature of the load—*e.g.*, steady or otherwise, continuous or intermittent, &c.
(5) Method by which power is to be transmitted from the motor.
(6) Situation where the motor is to be installed and temperature and cleanliness or otherwise of the surrounding air.

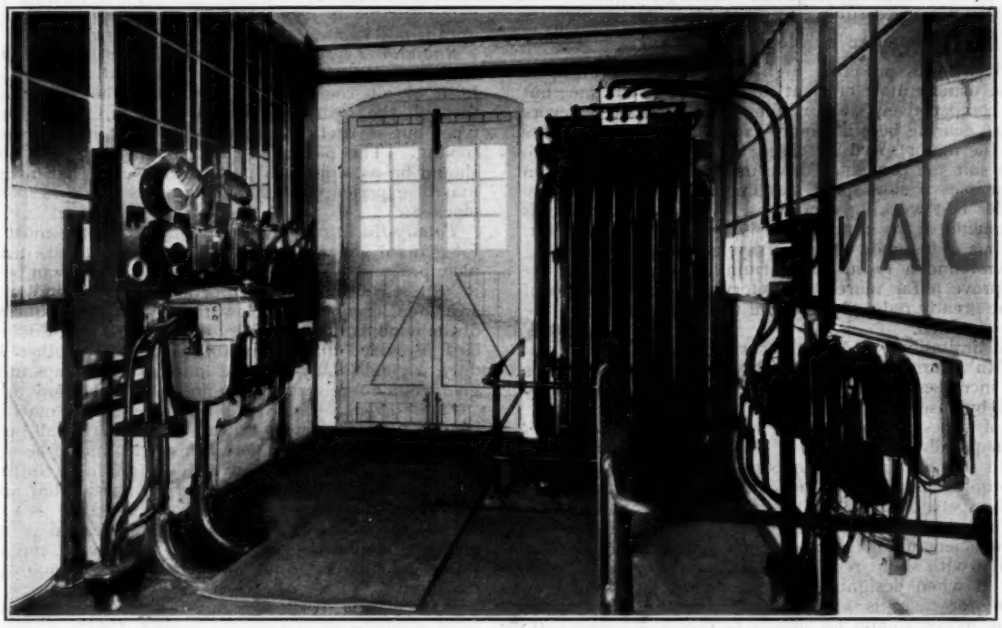
Taking item 1 first, the supply is generally settled beforehand, but care should be taken to obtain correct particulars. Care is necessary in determining the size of motor required, and, as usual in engineering practice, lack of exact knowledge must be allowed for by an increased factor of safety. A motor that is too small will always be an anxiety and is fairly certain to give trouble sooner or later, while one that is too large entails unnecessary capital expenditure and lower efficiency, particularly in the case of an A.C. machine. Individual circumstances vary so much that it is impossible to lay down hard and fast rules as to the best margins to allow, but as an approximate guide a load factor of about 75 p.ct. is quite a good figure to aim at, provided the load is reasonably steady.

If by installing a motor slightly larger or smaller than the size thus arrived at a duplicate of one already in use or projected in the future can be used, considerable expense in spare motors may be saved as one spare may serve for several machines, or in an emergency it may be possible to take a motor or component from another plant until the faulty one can be repaired.

Starting Torque.

The starting torque which a motor can exert is just as important as the horse-power it develops under normal running conditions, and when choosing a motor this point should be considered very carefully. Much of the machinery used on gas-works, such as conveyors, compressors, stoking machines, and cranes, requires a very heavy starting effort. Drag link conveyors and pushers on stoking machines are particularly bad in this respect, and the former should be run at frequent intervals when out of use, or the combined effect of corrosion and accumulated rubbish in the trough is to make the chain almost immovable. Fans, centrifugal pumps, and light belt-driven machines are as a rule much easier to start, and starting torque becomes less important than the power required to run them. Where the required starting torque is excessive it may be necessary to install a motor which is considerably bigger than is required to keep the machinery running once it has been started. In the case of a crane or stoking machine, where starting is very frequent and the actual running time per start is comparatively short, such inefficiency is not so important as where the runs are long and a large motor entailing high capital cost is running for many hours under an uneconomical load. Table 1 gives some idea of the starting torques and starting currents of the different types of motor which are commonly used.

These figures have been supplied by one of the leading motor makers and may be taken as representative of modern standard machines. It should be emphasized, however, that there are no hard and fast rules for the design of motors, and wide variations of the figures given may be obtained for special purposes. For example, take the case of a compound-wound



TRANSFORMER AND SWITCHBOARD AT THE WILLIAM CASH WORKSHOPS OF THE CROYDON GAS COMPANY AT PURLEY.

D.C. machine. This has two distinct field windings—the series winding through which the armature current flows and the shunt winding which is connected across the supply mains and provides a constant field. Such a motor is, in effect, a shunt-wound machine, but with a higher starting torque owing to the fact that the armature current, which varies according to the load, is strengthening the field when this is most required. A compound motor, therefore, may be anything from a series machine with a small shunt field to prevent the speed rising too much on light load to a shunt machine with a few series field turns slightly to increase the starting torque. The figures in the table relate to ordinary commercial machines such as would be supplied if a motor was merely ordered as (say) "Compound Wound," without any details of the required duty being given.

TABLE I.—*Typical Starting Torques and Currents of Standard Motors.*

Type of Motor.		Starting Torque. Percentage of Full Load Torque.	Starting Current. Percentage of Full Load Current.	Approximate Percentage Efficiency of Motor (See Note below) at 75 p.ct. Full Load.
D.C. Motors	Series wound	250	250	85
	Shunt wound	100	100	82
	Compound wound	150	150	82
A.C. Motors (3 phase)	Squirrel cage—			
	Direct starting	125	600	85
	Star delta starting	41	200	85
	Auto trans. starting (70 p.ct. tapping)	62	295	85
	Slip ring	100	120	84
	High torque squirrel cage—			
	Direct starting	200	450	80
	Auto trans. starting (70 p.ct. tapping)	100	300	80

NOTE.—P.Ct. efficiency of motors. Taking a machine of about 10 H.P. at about 1000 r.p.m. in each case.

CHARACTERISTICS OF DIFFERENT TYPES OF MOTOR.

The type of motor necessary for a given drive depends, of course, chiefly on whether the supply is alternating or direct current.

In the D.C. series motor the field is energized solely by the current passing through the armature. This type is suitable where high starting torque is required, as for stoking machines and cranes. Series motors are very simple and robust in construction, and such machines have given splendid service in gas-works for many years. Perhaps their most serious limitation is that they must never be used where there is any risk of their running light, as owing to the diminished field they may speed up until the armature bursts owing to centrifugal force. For this reason a belt-drive should never be used with a series motor owing to the risk if the belt should come off. Another disadvantage is that the speed drops under load, being in fact almost inversely proportional to it.

The shunt motor has separate armature and field circuits and is used in cases where a high starting torque is not required. The speed drops slightly with an increasing load.

The compound motor, which is a combination of the series and shunt, has already been discussed and is perhaps the most widely used D.C. motor, the characteristics of a standard machine falling roughly half-way between the previously mentioned types, with a useful starting torque for most purposes. Compound motors may be wound to give practically constant speed under varying loads or even to increase speed under load if required.

Coming to A.C. motors, we can only consider here the three-phase system, as this is the most useful and generally employed for industrial power. It is always desirable to use a squirrel-cage motor if possible, owing to its simplicity and cheapness, as there are no moving windings and current collecting gear. The first cost of the motor and starter is low, but its great disadvantage is the poor starting torque, which can, however, be improved in certain special types. Such a motor is shown in Table 1, from which it will be seen that to obtain 200 p.ct. of full load torque the motor must be switched direct on to the mains and requires 450 p.ct. of full load current, which is not always a practicable method.

Alternating current motors, unlike D.C. machines—which can be wound for any reasonable speed—can only run at certain definite speeds which can be determined approximately by the following formula:

$$\frac{\text{Frequency} \times 60}{\text{No. of pairs of poles}}$$ *less* approx. 5 p.ct. for "slip."

The synchronous speeds, from which the "slip" must be deducted, for several frequencies of supply are given in Table 2.

TABLE 2.

Frequency.	Synchronous Speeds, r.p.m.						
Cycles per Sec.							
25	1500	750	500	375	300, &c.		
40	2400	1200	800	600	480	400, &c.	
50	3000	1500	1000	750	600	500	428, &c.
60	3600	1800	1200	900	720	600	515, &c.

Squirrel-cage motors can be wound to run at two or even three alternative speeds if desired, but this is the only speed variation possible.

Slip-ring motors have a better starting torque, require less starting current, and are used where these prohibit the use of a squirrel-cage motor; but they have the complications of a wound rotor with slip-rings and brushes. Like the former, they run at set speeds, although reduction is possible by inserting resistance in the rotor circuits. This is, however, an inefficient method if the normal speed has to be reduced for any

length of time, and if the required starting torque is not excessive the multi-speed squirrel-cage motor is preferable.

Speed of Motors.

For a given horse-power a high-speed motor is cheaper, smaller, and usually more efficient than a slow speed one; but for driving comparatively slow moving plant such as conveyors the necessary gearing becomes more expensive, larger, and less efficient as the motor speed increases; so a compromise has to be made to suit the particular drive under consideration. On general principles a slow-speed machine is less likely to give trouble under bad working conditions. When a belt drive is used the diameter of the motor pulley is a very important point. If a choice has to be made between (say) a 6-in. pulley running at 1500 r.p.m. and a 12-in. pulley running at 750 r.p.m. the latter will prove a far more satisfactory job in the long run owing to the greatly reduced wear and tear on the belt and the better drive obtained.

The speed limitations of A.C. motors have already been discussed. With shunt and compound wound D.C. machines fairly large increases above the normal speed of the motor may be obtained by inserting resistance in the shunt field circuit. The speed of series motors can be increased by connecting a resistance in parallel with the field windings, a method sometimes used in stoking machines and similar plant where a quick return is required for which the full starting torque is not needed. The speed of shunt and compound motors can only be reduced below normal by inserting resistance in the line—an obviously inefficient method, but one which is sometimes used in conjunction with shunt regulation to obtain very large speed variations. If when designing a plant driven by a shunt or compound motor there is some doubt as to the exact speed required, the motor should be chosen to give the lowest estimated speed, as it is an easy matter to increase it (within limits) afterwards, but not to reduce it.

Power Factor.

A very important figure in alternating current systems is the power factor or ratio between the real and apparent power passing in an A.C. circuit. A low power factor means that larger currents have to be carried for a given horse-power, and therefore unnecessarily large cables have to be used. Some supply authorities charge for the apparent power (volts × amperes) used, and in this case the customer suffers directly if the power factor of his plant is low. Motor makers will always give guaranteed figures for their machines at various loads. Two golden rules are: First, to run motors at as high a load factor as possible with safety, and, secondly, to avoid using very slow speed machines, as the power factor of these is invariably low.

Ratings.

Standard motors for ordinary purposes are continuously rated —*i.e.*, they are designed to develop their full rated power for an unlimited time, their temperature keeping within certain limits, and they are also capable of withstanding specified overloads for certain periods. Full particulars of these ratings are to be found in the B.E.S.A. Specifications for Motors and Generators, and figures for any proposed machine will always be given by the maker. Standard motors are quite suitable for most uses; but in cases where the load is intermittent, as with cranes, stoking machines, haulage gears, &c., considerable economies in cost, weight, and space may be effected by using an intermittently rated machine. In such cases, however, the motor maker should be given full particulars of the duty to enable him to put forward a suitable machine. One of the most important factors which limit the horse-power a motor can develop is the rise of temperature due to losses in the machine; and if a motor is to be installed in a hot situation the increased temperature must be allowed for, and either a larger machine with a lower temperature rise or a specially ventilated motor may have to be used.

Enclosures.

Gas-works conditions are by no means ideal for the operation of delicate machinery, and although modern electrical apparatus gives remarkably good service in adverse circumstances, care in selection and maintenance is essential if the best results are to be obtained. There are many different types of enclosure to meet various conditions, almost every maker having special designs of his own, but they can all be divided broadly into the following classes:

Enclosed Ventilated.—The openings in the machine are covered by some form of grating which protects the interior to a certain extent. This is the cheapest and most compact form of motor, but there are few places in a gas-works where it is really suitable.

Drip-Proof.—A variation of the above, with louvres or cowls, which prevent any water falling from above from entering. The greatest enemy on a gas-works is the fine dust from coal, coke, or oxide, or all three, which is nearly always present, and unfortunately neither of the above types affords adequate protection against this.

Pipe-Ventilated.—Where the motor is in a very warm or very dirty situation this is a useful type if really clean dry air is available nearby. If the inlet pipe is sucking in dust and damp trouble is inevitable. A filter can be fitted on the air inlet if necessary.

Radiator Type.—This includes numerous machines bearing trade names, which are totally enclosed and fitted with some form of air cooler. The air inside the motor is circulated through the system by means of a fan. It is an expensive type, but is useful in certain cases as it gives very efficient cooling. The passages through which outside air is drawn should be as simple as possible and easily cleaned, or trouble may be experienced in dusty situations owing to these becoming blocked.

Totally-Enclosed.—This is undoubtedly the most useful type for general gas-works use, as, if well designed, it affords complete protection against dirt and weather and can be used safely in exposed situations. Unfortunately, it is bulky and expensive, due largely to the low ratings and consequent large size of the windings, &c., owing to the limited heat dissipation possible. Provided that the motor is suitable in other ways for its duty, a good totally-enclosed machine is perhaps more likely to give trouble-free service in a gas-works than any other type.

Flame-Proof.—These are totally enclosed machines having heavy covers with wide machined joints over all openings, and are designed to be completely gas-tight and to be able to withstand an internal explosion without igniting a surrounding gas mixture. They are naturally very expensive but are necessary in certain situations.

I hope that these remarks on the selection of motors may serve to emphasize the necessity for giving the makers the fullest possible information when asking them to quote for a machine.

It is perhaps needless to say that the openings of any ventilated machine must never be interfered with in any attempt to protect the motor, as this will almost certainly cause serious overheating. For the same reason motors should not be encased in "dog-kennels." If a suitably protected motor has been chosen these are unnecessary and hinder inspection besides preventing proper air-circulation.

Starting Equipment.

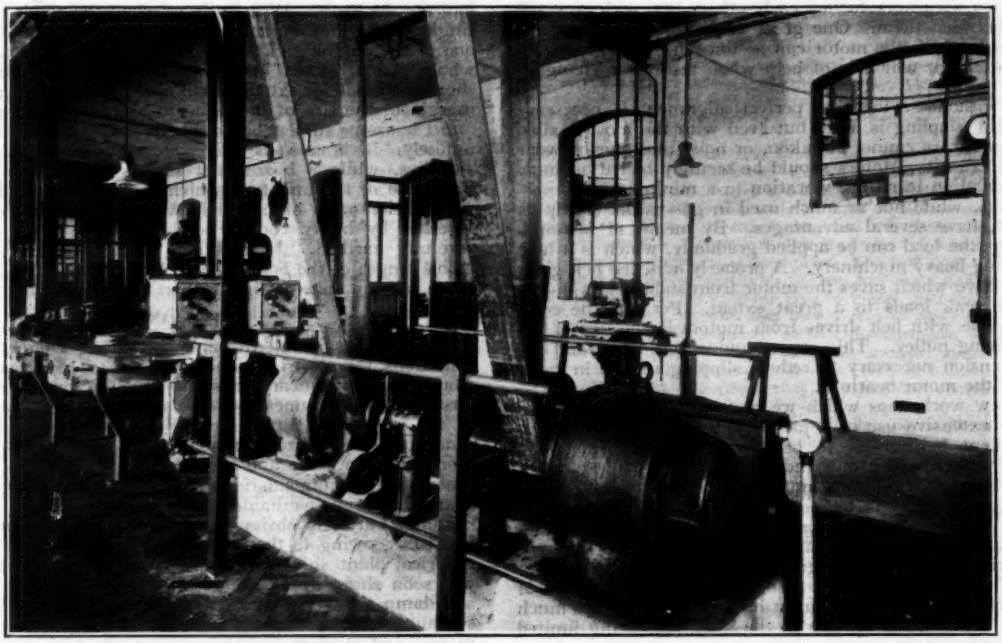
A starter of some sort is essential for all but the smallest motors, and demands as much care in selection as the motor itself, which may be put completely out of action if trouble develops in the starting gear. A complicated starter is often a more potential source of trouble than the motor owing to the considerable number of small parts which it contains, and for satisfactory operation in gas-works only the highest grade of starting gear should be used. When buying electrically-driven plant of any sort, care should be taken to find out exactly what sort of starting equipment is included, as there is sometimes a tendency to cut prices in this direction, the suppliers apparently knowing only too well the indifference of some purchasers who consider starters mere details.

One of the most important parts of any starting equipment, either A.C. or D.C., is a good main switch, by means of which the starter and motor can be completely isolated from the supply mains, enabling inspection, cleaning, and repairs to be carried out in safety. The more elaborate type of starter usually has an isolating switch built into it, and, although this is a very compact and safe arrangement, it has the disadvantage that, should it be necessary to remove the starter bodily, the current has to be cut off further back in the circuit. For this reason, where there are several motors on a plant, each should be supplied through separate cables from a distribution board in a position as nearly central as possible, so that each run of cable with its starter and motor can be completely disconnected without interfering with other circuits.

In a D.C. starter the other essentials are a rheostat to limit the current when starting, an overload trip, and a "no-volt release," to stop the motor automatically in case of overloading or failure of supply respectively. If the speed of the motor is to be variable a rheostat is necessary in the shunt-field circuit. While not essential, an ammeter is most useful and is usually well worth the extra cost.

Many varieties of starters on these lines are obtainable, ranging from the simple "box" type to the elaborate "pillar," a completely enclosed unit containing electrical and mechanical interlocking devices which render the starter practically foolproof and make it almost impossible to damage the motor or starter by careless starting. Naturally, there is a great difference in price between these extremes, but the "pillar" type is becoming increasingly popular on gas-works owing to its reliability, the protection it affords to the motor, and its suitability for operation by unskilled labour. For workshops and protected places, where conditions are not so exacting, simpler types may be used. For stoking machines, telphers, and other pieces of plant which have to be started very frequently drum controllers with separate banks of resistances are generally used.

A.C. motors may be started in several ways, the method depending on the type and size of motor. Squirrel-cage machines of up to about 20 h.p. are often switched directly on to the mains, but care must be taken when considering this owing to the heavy momentary current taken while the motor runs up to



MACHINE SHOP DRIVES AT CROYDON GAS-WORKS, SHOWING 15 H.P. 220-VOLT D.C. MOTORS WITH "LENIX" JOCKEY PULLEYS.

speed. Most supply authorities have regulations limiting the size of motor that can be started in this way, and they should be consulted when installing a machine for use on a public supply. On private plants used chiefly for power the sudden peak and consequent voltage drop are not so important, but it should be seen that the cables, fuses, and circuit breakers concerned are of adequate capacity to deal with them.

For direct-on starting it is best to use an oil-immersed circuit breaker fitted with no-volt and overload trips, with dashpots on the latter which should be adjusted to prevent the circuit breaker opening when starting the motor under normal conditions, but to allow it to act if an overload is sustained for any length of time when the machine is running. It should be hardly necessary to mention that overload trips on starters must be adjusted to suit individual conditions. The makers are obviously unable to set them beforehand, but it is not uncommon for a starter to be installed and left without any attention being paid to them. Very small squirrel-cage machines may be started by means of an ordinary switch-fuse, but this method is not suitable for machines of over 1 H.P.

When direct starting is not practicable "Star-Delta" or auto-transformer starting may be adopted, the effect of both systems being to limit the starting current.

For certain plant—such as conveyors, for instance—it is sometimes found that while "Star-Delta" starting is satisfactory under normal conditions, a higher starting torque is required occasionally. In such cases it is often possible to arrange for "Star-Delta" starting for ordinary use and direct starting when required.

An auto-transformer reduces the voltage at the motor terminals. This method of starting is employed when a higher starting torque than that obtained with "Star-Delta" starting is required, or when the exact starting torque needed is not known, as the voltage applied to the motor can be varied by means of tappings on the transformer.

Slip-ring motors are started with resistances in the rotor circuits, and provision is usually made for lifting the brushes off the slip-rings and short-circuiting the rotor windings when the motor has reached full speed. The motor then operates in the same way as a squirrel-cage machine.

The larger sizes of A.C. starting gear for gas-works use should be oil-immersed, care being taken to use only the correct grade of oil, which must be perfectly clean and free from moisture. The contacts should be inspected frequently, and the condition and level of the oil watched closely.

Automatic Starters.

There are many applications on gas-works for automatic starters controlled by push-buttons, float switches, pressure, or temperature relays. Automatic D.C. starters at Croydon at the present time total 273 H.P., and a deep well equipped with a 28-H.P. borehole turbo pump is being put to work at the moment. This will be controlled by a float switch over a quarter of a mile away, and will provide all the water required at the works. A 180-H.P. gas compressor, a 12-H.P. pneumatic hammer, a punching and shearing machine, and a large telpher are among the automatically-controlled plants which work quite as satisfactorily as those with hand operated starters. An advantage of automatic starting is that, provided the starter is once set correctly, the motor cannot be started too quickly, with the consequent possibility of damaging the plant, as may happen with hand operated starters. One maker fits a very ingenious retarding device which, through the action of eddy currents in a rotating aluminium disc, regulates the time taken to start the motor according to the load. When choosing any starter, but particularly an automatic one, care should be taken to avoid those which have numbers of small springs and delicate parts, and a gear should be selected which is as simple as possible for the work. Trouble is likely with these small parts wherever the starter is; but in a gas-works it is almost inevitable.

Transmission of Power from an Electric Motor.

Power is generally transmitted from a motor by one of the following methods: Direct coupling, belt drive, reduction gearing, or chain drive.

These systems are too widely known to need any description, but even so there are a few points which require attention when using a motor in conjunction with any of them. One is that a standard motor is not designed to withstand any appreciable end thrust. Trouble from this cause is most likely to occur when the motor is direct-coupled to another shaft, and should be guarded against by providing the driven shaft with some form of thrust bearing, and it is also desirable to use a flexible coupling which permits ample endwise movement or "float" for the armature shaft. Motors can be fitted with special bearings to take a certain amount of endthrust when essential as in the case of vertical spindle machines for instance.

Another point that is often overlooked is the amount of kinetic energy stored up in the armature of a motor running at high speed. With a drive in which the motor is positively connected to the driven machine, with nothing that can "give," it is not really sufficient to fit overload releases or circuit breakers and rely on these to prevent damage. In the case of a dead stop due to a machine becoming jammed, the whole of the stored up energy in the armature, acting, perhaps, through a very big gear ratio, is suddenly exerted, even if the current has been automatically cut off; and there is a serious risk of something being strained or broken. For this reason, it is a great advantage to fit shearing pins either in the motor coupling or as near it as possible in any positive drive. These should be carefully fitted to ensure a clean shearing action, and steps taken to see that broken pins cannot work out and do any damage before the motor stops. Excessive strains may be caused by brakes if these act too violently. I have recently seen the shaft of a small motor twisted completely off through this cause. Electrically operated brakes are preferable, as these can be adjusted to give reasonably gentle braking, and are not so liable to be abused as those manually operated.

Some form of flexible coupling is an advantage on direct-coupled drives, the rubber bush type being as good as anything for the smaller powers. We have a number of the Renold

chain type in use at Croydon, in which a double roller chain fits over two sprockets facing each other, but with a small clearance between them. One great advantage of this type is the ease with which the motor can be uncoupled merely by removing the chain, which is of help when testing or changing the motor.

It goes without saying that perfect alignment is necessary when a rigid coupling is used, but even with the most flexible type too much care cannot be taken, or noise and uneven wear are likely to result. Motors should be securely bolted down to a rigid foundation to reduce vibration to a minimum.

Belt drives, while not as much used in gas-works to-day as in the past, have several advantages. By means of fast-and-loose pulleys the load can be applied gradually, which is a help when starting heavy machinery. A properly adjusted belt gives a resilient drive which saves the motor from sudden jars due to momentary peak loads to a great extent. Perhaps the commonest trouble with belt drives from motors is the use of too small a driving pulley. This causes undue belt wear, and the excessive tension necessary to reduce slipping results in rapid wearing of the motor bearings.

In the new workshops which we have recently equipped we have made extensive use of a jockey pulley device, which enables excellent belt drives to be installed where otherwise, owing to cramped space, only indifferent ones would be possible, and which often allows a much more compact drive to be used. The basic idea is by no means new, but the present device is a greatly improved form and employs a ball bearing jockey pulley. It is made in a number of forms for different types of drives, and the photograph shows one of the applications at Croydon. It will be seen that a very large arc of contact is obtained, and it is almost impossible to put too much tension on the belt, the tension in the slack side being limited by the counter weight, so that the stresses on the motor bearings are reduced to a minimum. Thin endless leather belts dressed with castor oil are used, but Balata is being used elsewhere with, I believe, satisfactory results. While it is obviously undesirable to use any such device where it is possible to install a really efficient long belt drive, I do think that it has very great advantages in many cases and has certainly proved most successful where we have used it.

A very satisfactory drive for drag-link conveyors and heavy plant, where a great reduction from the speed of the motor is necessary, consists of a totally-enclosed gear box with a final roller chain drive, preferably in a sheet-metal case forming an oil bath. This arrangement is efficient, compact, and very quiet, and is, I think, a great advance on the old unprotected trains of cast gears which were employed for such drives in the past. The first cost is perhaps higher, but experience has shown that maintenance charges are almost negligible, which is largely due to efficient lubrication and the exclusion of abrasive matter. All the drag-link conveyors and the larger elevators at Croydon are driven in this way. For lighter drives such as rubber belt conveyors and small elevators, enclosed worm gears are used, direct-coupled to the driving shaft in the case of belt conveyors and with roller chain final drive on elevators, &c. This is, I think, a rather unusual drive for belt conveyors, but is very compact and simple and is certainly satisfactory in use. Direct chain drives from motors are very useful where a large reduction of speed is not required.

Switchgear and Distribution Systems.

Switchboards in power houses are usually divided into two sections—"incoming" and "outgoing." The former comprise the necessary apparatus in connection with the generators or transformers and convey the current from these to the busbars which are mounted at the back of the switchboard. Outgoing sections convey the current from these busbars through suitable switchgear and measuring instruments to feeder cables which supply various parts of the works. The class of switchgear employed depends on the voltage and current to be handled, and may range from elaborate oil-immersed gear in the case of A.C. at high voltage to simple slate panels with air-break circuit-breakers or knife switches on low voltage D.C. systems.

On the older types of switchboards installed in gas-works there were often a number of small knife switches on the outgoing panels, almost every motor being fed by separate cables from a switch in the power house. This is a good system when the number of motors is small, but the greatly increased number of electrical drives is best dealt with by the feeder system, in which main cables or feeders are led to distribution boards in various parts of the works, which supply the motors in that area. A typical power house feeder panel consists of a circuit-breaker, ammeter, kilowatt-hour meter, and often a recording ammeter. It is thus possible to register the exact amounts of current used, and the circuit-breaker protects the plant in the event of a serious fault developing on the circuit.

Each electrically driven retort house or other plant should have its own switchboard housed in a suitable room. This should preferably be of the ironclad type, and will consist of a main switch or circuit-breaker to which the feeder cable is connected and a separate switch or breaker for every outgoing circuit, all the switches being connected to enclosed busbars. Suitable instruments may be fitted in the main and outgoing circuits to indicate the loads. With such a system the whole plant or any single motor may be completely disconnected, and trouble on one of the outgoing circuits will not entail the stoppage of the whole plant. When installing distribution boards allowance should be made for extensions of plant by providing an adequate margin in the size of the feeder cable. Even in the case of a retort house or similar board where large additions to plant are unlikely, it is always advisable to include several spare switches, while a board that serves a section of the works should be of the unit type which can be easily added to later. All exterior parts of ironclad switchgear should be connected together by heavy copper bonds and the whole framework carefully earthed. In addition, a rubber mat running the whole length of the board should be provided for use when any work is being done on the live parts of the board.

Maintenance.

It would be difficult to name any plant where the working conditions for electrical machinery are worse than in a gas-works, and every care must be taken if breakdowns due to dust, damp, and fumes are to be avoided. Not only must plant of the highest quality, carefully selected with regard to the conditions it has to withstand, be used, but regular and thorough inspection and cleaning are essential. One sometimes sees recommendations that motors should be completely dismantled and overhauled after such and such a period of running, but it is obviously futile to lay down any hard and fast rules, owing to the wide variations in circumstances. All electrical plant should be inspected frequently, and experience will soon show where the greatest attention is needed. Dust and damp are the greatest enemies of electrical apparatus, and sulphur fumes are often an unsuspected cause of trouble. All motors and starters should be blown out with a portable electric blower, or, failing this, a pair of bellows, at frequent intervals to remove dust, while the greasy deposits which are so apt to form on gas-works should be carefully cleaned off where possible. Gaskets and felt joints on the doors of enclosed apparatus must be kept in good order, and the doors should fit tightly and be kept shut. All contacts on switchgear, &c., must be inspected and kept clean not forgetting those in oil-immersed switchgear which are out of sight and therefore liable to be out of mind.

Commutators should be carefully watched for undue wear, chattering, or sparking, and should be trued up in a lathe when badly worn, but left alone if working properly. A commutator should acquire a high polish and become a dark brown colour. This is the ideal condition, and once this "skin" is formed a commutator should not cause trouble. The micas between commutator bars should be undercut a little but not more than (say) $\frac{1}{16}$ in. Excessive undercutting serves no useful purpose whatever and is likely to cause trouble due to dirt becoming lodged between the bars.

Motor bearings should be examined regularly for undue wear, and the clearances between the pole pieces and the armature or rotor carefully checked from time to time. If this is neglected serious damage may result owing to fouling. Ball or roller bearings should be inspected periodically, cleaned and recharged with one of the special greases sold for this purpose, care being taken not to put in too much, as this may cause the bearing to run hot. Most makers recommend that they should be about two-thirds full.

Flexible braids made of a large number of very fine copper wires plaited together are largely used in starters and for connections to motor brushes. These must be tinned for gas-works use, or trouble may be experienced due to corrosive action which very quickly destroys them owing to the large surface exposed.

It is impossible to deal here with all the points that require attention in electrical plant on gas-works, but one thing is certain—that time and money spent in careful maintenance will be repaid many times over by the good service given by plant that is well looked after.

In conclusion I must thank Mr. Walter Grogono, the Engineer of my Company, for allowing me to read this paper and the following firms for lending me lantern slides: The British Thomson-Houston Co., Ltd., Brookhirst Switchgear, Ltd., Crompton Parkinson, Ltd., Joseph Evans & Sons (Wolverhampton), Ltd., Igranic Electric Co., Ltd., the Lancashire Dynamo and Motor Co., Ltd., and Metropolitan Vickers Electrical Co., Ltd.

Discussion.

The President: This is the first time this Association has had presented to it a paper dealing exclusively with electrical plant in the carrying-out of gas-works operations, and we are fortunate in having obtained one of our own members to advance the merits of electric motors as prime movers. Mr. Webber has done this in an essentially practical manner. Every gas engineer, whether connected with gas manufacture or supply, should have a sound working knowledge of the uses of electricity for both power and lighting. Electrical engineering is now accepted as one of the ancillary subjects in the Institution of Gas Engineers Education Scheme; and while the number of students submitting this particular ancillary subject is at present small, it shows signs of increasing. It will most certainly be to the future advantage of the gas industry if all

its members are properly acquainted with the actual capabilities of electricity. In the paper we have had this evening, Mr. Webber has wisely devoted himself in the time at his disposal to one section of electrical plant—motors. He has mentioned that, when considering the installation of electric drives, the fullest information should be given to the contractor, and then faith put in his judgment and advice. This is a wise plan; but electric motors are only satisfactory if adequately maintained, and unless the number of motors merits the employment of qualified supervision trouble may be experienced. The policy of ensuring that motors in different parts of the works are, as far as possible, duplicated is a good one, and applies equally to pumps and steam engines. But the slight changes in design that seem to be introduced from year to year, in order to stamp more definitely the date of production, and to demonstrate manufacturing progress, tend to decrease the advantage of this policy.

Mr. Webber has advocated the advantages of belt drive, and several of the lantern slides illustrated these; but in another part of the paper he points to the serious limitation of this system—namely, the running away of the motor, and the possible bursting of the armature, owing to centrifugal force, if the belt should come off or break. I should like Mr. Webber to reconcile these two points. The higher capital cost of the D.C. machines is not very important when viewed in relation to the length of life and maintenance charges. The advantages of direct current are such that, although the emergency supply usually obtained from local power companies will in the near future be only A.C., it will probably prove good policy to duplicate D.C. generators, so as to maintain the particular merits of D.C.—*i.e.*, high-starting torque and variable speed. The higher capital cost of D.C. plant in comparison with A.C. is not very important when viewed in relation to length of life and maintenance charges. I suggest that we can with advantage discuss the advisability from the point of view of policy of lighting the works with electricity.

Mr. W. J. Sandeman (General Manager to the Croydon Gas Company) congratulated Mr. Webber on his paper.

Mr. S. Holdway (Gas Light and Coke Company) also paid tribute to the paper. He considered that a little more emphasis might be given to the guaranteed overload rating of motors in connection with the starting torque. In many cases that load was quite sufficient to keep the motor down to reasonable limits. Mr. Holdway advocated a good starter for electric motors, for if one put in a good starter in the first place a great deal of expense was saved afterwards, and a large amount of the cost of running the plant would be eliminated in this way. He thought that the use of synchronous motors was very useful for maintaining the power factor at a reasonable figure. The matter of starters might be taken up with more keenness, and these might be made on the trunk principle, in order to change the starter quickly. They would thus never have the plant out of action for any length of time. In conclusion, Mr. Holdway expressed the hope that Mr. Webber might in the near future read a complementary paper on the subject of the generation of cheap current. This was the most important point so far as the application of electricity to gas-works was concerned.

Mr. J. H. Goldsmith (South Suburban Gas Company), the Senior Vice-President, remarked that Mr. Webber had not mentioned anything about voltage drop when dealing with the selection of motors. This was a matter which sometimes escaped notice; there might quite well be anything up to a 20-volt drop—a point not to be lost sight of when ordering motors. Another type of drive was the primary drive by means of inverse tooth chain, which was run over spur gearing to enable silent running. In conclusion, Mr. Goldsmith inquired what were the maximum efficient speeds for reasonably large motors.

Mr. W. Grogono (Croydon) stated that at Croydon they had 1400 H.P. of motors on the gas-works and 140 H.P. of motors at the workshops, so that Mr. Webber handled every day a very large horsepower, and he really did know what he was talking about. Up to two or three years ago it was the general practice of gas-works to generate their own current—some very expensively, some more cheaply where waste heat was available. But surely they were now in close enough touch with suppliers to buy current where possible. They were able to give a twenty-four-hour load, and the electricity suppliers might thus be able to give very cheap current. This was being done at Croydon. They had two supplies—460 volts D.C. and 6000 volts A.C.—and they experienced no trouble whatever in the operation of this system, except on one occasion when one of their overhead cables was struck by lightning, and in this case the current was going again in three-quarters of an hour. In regard to the "Lenix" drive, he used to criticize this method, because it had a pulley on the back of the belt, but he found that this had no effect on the life of the belt. A large number of these drives had been put in at Beckton. There was a lot to be said for driving plant on a gas-works by electricity. A check could always be kept on the various plant, for one could see immediately if a particular piece of apparatus was taking more current than usual, and thus straightway know that something was wrong. Further, electricity enabled them to make use of a lot of plant and carry out engineering jobs that would be impossible without electricity—such as telphers, stoking machines, and so on.

Mr. W. T. Kenshole (Lea Bridge) said that he was under the impression that the weak point of electricity, generally speaking, was not at the generating end, but in the distribution system and in the transformers. In regard to the various types of motors mentioned, there were several points that struck one, and one of the things they came up against was in connection with waste-heat fan motors; difficulty arose owing to atmospheric conditions. This had a great influence upon the degree of cooling necessary. They had some difficulty in regard to the cleaning of the radiator type of motor, and the only way they had found of dealing with this matter was to carry out the cleaning while the motor was running, so that the dust was, in effect, blown out. Another point in regard to totally-enclosed motors was that it was essential to keep the outside case clean in industrial situations. Finally, Mr. Kenshole stated that they had had considerable trouble in regard to flexible braid.

Mr. G. W. Tatam (Croydon) said that he could vouch that the drives which Mr. Webber had illustrated to them were most effective and very quiet in operation. In the case of rubber belt drives—in water gas plants in particular—there might in the old days have been as many as six drives with multiple-case iron gears. There used to be a fearful noise with this plant. Now the noise had been eliminated to some extent, but not entirely. He realized the extreme value of electrical drives in a large factory. One could put the motors down with the greatest of ease, whereas in former times one had to put down some piping and bring along a little engine to it.

The Author's Reply.

Mr. Webber then briefly replied to some of the points raised in the discussion. In reply to the point raised by the President on the subject of belt drives, he said that his remarks in connection with the limitation of the system, on account of the running away of the motor should the belt come off or break, related only to series wound D.C. machines. In any of the other types of motor the speed might be increased by the breaking of the belt, but in these cases it would be perfectly safe. In reply to Mr. Holdway, he stated that the starting torque could be made bigger. It was generally agreed that every penny paid for a good starter was worth while. Mr. Webber considered the suggestion put forward in regard to the truck system excellent. In regard to synchronous motors, that was a point that he had intended to deal with; these were a most useful means of improving the power factor. In reply to Mr. Goldsmith's remarks in regard to cables, Mr. Webber said that a cable should be put in to allow for a voltage drop of at least 3 p.ct. The whole secret was to put in a cable four times as large as was needed. In regard to driving by means of inverse tooth chain, he considered this an excellent method; but it must be enclosed. It was not easy, however, to get big speed reductions—such as 160 to 1, as they had at Croydon. In reply to the question concerning the speed of motors, he said that this was rather a difficult matter, as it was dependent very largely upon the motor itself. Fans required a speed of about 3000 r.p.m.; 750 to 1500 r.p.m. was a normal speed for motors, about 75 p.ct. of electric motors falling within this range. With direct current the speed of the motor was, of course, dependent upon the peripheral speed of the commutator. It was possible to make a motor to run at any speed practically, within reason; it being only a matter of expense.

In reply to Mr. Kenshole, he said that trouble might occur on any distribution system. The distribution system should be so arranged that in the event of the supply failing at a particular point as little dislocation as possible would ensue. Transformers should not give a great amount of trouble. The cleaning of radiator motors while running was a good idea; there was not, as a rule, much trouble in keeping the totally-enclosed motor clean. In regard to the trouble experienced with braids, they were now asking makers to supply tin braid. This was not perfect, but they did not get so much trouble.

Vote of Thanks.

Mr. Goldsmith proposed, and Mr. A. Tennant (East Surrey), the Junior Vice-President, seconded, a very hearty vote of thanks to Mr. Webber for his paper, to which Mr. Webber briefly replied.

Joint Council of the Junior Gas Associations

A Meeting of the Junior Gas Associations' Joint Council was held in London on Oct. 20, under the Chairmanship of Mr. F. S. Larkin, A.M.I.Mech.E. The delegates present were: Messrs. W. J. Pickering (Education Representative); T. H. Prater, J. H. Goldsmith, F. H. Higton (London and Southern Association); C. H. Bamber, H. C. Applebee, J. Alsop (Manchester and District); Duncan Melvin, Alex. MacDonald, Alex. Bujnowski (Scottish Western); W. Macnaughton, H. C. Wills (Midland Association); J. W. Horwill, J. W. Holroyd, R. Crowther (Yorkshire Association); C. H. Collins, S. E. Brett, H. S. Bartlett (Wales and Monmouthshire Association); J. T. Spencer, G. C. Gunston, W. M. Paterson (Western Association); H. B. Knowles (Hon. Secretary and Treasurer); and T. B. Armitage (Hon. Secretary and Treasurer Elect).

After the delegates had been introduced to and welcomed by Mr. R. W. Foot, General Manager of the Gas Light and Coke Company (who were acting as Hosts to the Joint Council that day), Mr. F. S. Larkin, the President, called attention to the long and interesting agenda in front of them.

In view of the arrangements that had been made on their behalf, the delegates, he hoped, would assist him to conduct the business of the meeting in as little time as possible. He would therefore ask if someone would move that the minutes of the last General Meeting held in Glasgow on Oct. 5, 1929, be taken as read, as each delegate had had a copy posted to him.

On the motion of Mr. Alsop, seconded by Mr. Bujnowski, this was carried.

The Secretary read out the correspondence concerning affiliation to the Joint Council of the Scottish (Eastern) Association, and on the motion of Mr. W. J. Pickering, seconded by Mr,

MELVILLE, it was decided to leave this matter in abeyance for the time being.

The SECRETARY read out a letter from the Western Association, recommending the appointment of Mr. T. B. Armitage as the Hon. Secretary and Treasurer to the Joint Council for the ensuing session. Letters from the Hon. Secretary of the London Association and from the Hon. Secretary of the Midland Association, specifying the copies of Transactions they had collected towards a Library which would be presented in the near future to the Institution of Gas Engineers, were read.

On the motion of Mr. KNOWLES, seconded by Mr. HIGTON, it was decided that the completion of the Library be left to the Hon. Secretaries of the London Association, the Midland Association, and the Hon. Secretary of the Joint Council.

The Hon. Secretary's report and balance-sheet were then presented, and on the motion of Mr. ALSOP, seconded by Mr. HIGTON, the above were passed as being correct. The Transactions Account for Volume 19 were also passed as correct—each Association having had a copy forwarded to them during the Session.

On the motion of Mr. SPENCER, seconded by Mr. GUNSTON, Mr. T. B. Armitage, of Cheltenham, was duly elected Hon. Secretary and Treasurer of the Joint Council.

On the motion of the PRESIDENT, the retiring Secretary—Mr. Knowles—was accorded a hearty vote of thanks for the work he had so ably carried out in the past.

The PRESIDENT then called upon Mr. W. J. Pickering to give the Educational Representative's report.

REPORT OF THE EDUCATIONAL REPRESENTATIVE.

From some points of view the working of the Education Scheme during the year since our last meeting has not been as satisfactory as could have been desired. The seventh session of the scheme, being the first under the Revised Regulations, did not show a substantial increase in the number of external candidates for the examinations in the Major Courses. The actual figures as compared with the previous session, were 71 for 1930 and 108 for 1929. The figures for the internal candidates showed a slight increase, from 239 to 241.

The Minor Grouped Courses in Gas Supply Practice and in all three grades of Gas Fitting showed considerable increases in the number of candidates, there being 249 more entrants in 1930 as compared with 1929. The total number of candidates entered for all examinations in gas subjects showed an increase of 214 as compared with the previous year, and reached the figure of 1491. As the Education Committee's Report to the Institution, on May 13 of this year, remarks: "There is satisfaction to be found in the continuous growth in the number of entrants, but there is still much to be done before the number of students taking classes can be said to be reasonably proportionate to the number of employees in the industry."

During the past 12 months one of the most noteworthy features in connection with the Scheme has again been the work of the various District Committees. There is one matter in particular I should like to mention in this report, as it has probably been noticed by all of us, and it received very careful discussion at the last meeting of the General Education Committee. I refer to the matter of tuition by correspondence, and the possibility of a correspondence college being either officially recognized, or even run by the Institution. The communication from Mr. J. E. Blundell, of Carlisle, on this matter, dated May 26, 1930, and also a resolution on the subject from the Yorkshire District Committee, were duly considered.

The General Education Committee was unanimously of opinion that the question of official recognition or anything further in this connection did not, at present at any rate, come within the realm of practical politics so far as the Institution was concerned. It was, however, generally agreed that excellent work was being done by these correspondence authorities, and where a student desired advice as to help of this character in his studies, the District Committees would be glad to furnish information.

This particular matter is of considerable importance in connection with the Education Scheme, and will probably come up again for discussion at a later date.

Mr. ALSOP moved, and Mr. BUJNOWSKI seconded, a hearty vote of thanks to Mr. Pickering for the work he had so ably carried out in the past.

Mr. HORWILL moved that Mr. Pickering be again elected as Representative on the Education Committee. He said everybody around the table knew the value of Mr. Pickering's work.

Mr. PRATER seconded, and the motion was carried unanimously.

The PRESIDENT then gave his report.

OVERLAPPING.

It had been suggested that there was a certain amount of overlapping between the Salesman's circle and the Junior Gas Association; but after the views of the delegates had been obtained it was agreed that there was no appreciable overlapping.

Mr. KNOWLES introduced the question of members of the Institution of Gas Engineers not using the abbreviation after their signatures. It was agreed to ask all members who were entitled to use the abbreviation to do so on all appropriate occasions, and local Secretaries were asked to use same after members' names on the membership cards.

Mr. HORWILL extended a hearty invitation to the Council to hold its next meeting in Yorkshire, and this was unanimously agreed to, and Mr. Horwill was thanked for his invitation.

The meeting closed with a hearty vote of thanks to Mr. Larkin for presiding.

Western Junior Gas Association

Exhibition of Cinematograph Films

A Meeting of the Association was held at Bath on Saturday, Nov. 15, 1930—Mr. A. BARRETT (Frome) presiding.

A novel departure from the usual technical paper or works visit was provided by the exhibition of two cinematograph films describing the manufacture, erection, and operation of the various specialities of Messrs. W. C. Holmes & Co., Ltd., of Huddersfield.

Mr. S. G. WATSON, M.Sc. (W. C. Holmes & Co., Ltd., London), in introducing the films, described the first as showing in detail the principles of design, manufacture, testing, and erection of Holmes "Connersville" products, as carried out in the works of Messrs. Bryan Donkin, Ltd., of Chesterfield, who are associated with Messrs. W. C. Holmes & Co. in the manufacture of these "Connersville" products.

The second half of the programme was a film dealing solely with the manufactures of Messrs. W. C. Holmes & Co., showing the building and testing of their specialities such as condensers, brush washers, gas drying plants, &c., in the works at Huddersfield, with reference particularly to the details of internal construction and method of operation. As the films were shown, Mr. Watson gave a brief commentary describing closely the principal items of interest.

The films were received with considerable enthusiasm, and at the conclusion of the exhibition the President stated that the subjects were open for discussion, and that any questions regarding the technical details of these manufactures and plant would be welcomed.

Discussion.

Mr. A. BARRETT (Frome), opening the discussion, said that he was interested in the consumers' "Connersville Tandem" meter, and would like details of the operation of the valve mechanism whereby at the lower throughputs the gas was shunted from the "Connersville" meter to the diaphragm meter, and at the higher throughputs shunted back to the "Connersville" meter. He would be interested also to know the amount of slip geared into the index of "Connersville" meters, and how this was determined either at the shop test or in the gas-works. How did this slip vary with varying rates of throughput? With regard to the "Connersville" exhauster and booster, what were the normal and the minimum operating speeds?

Mr. C. BATEMAN (Bath) asked whether there were any reasons to anticipate, or whether experience had shown, that the slip would vary during the life of the meter, and, if so, would it increase or decrease sufficiently to affect the accuracy? He was interested also in the probable life of the bearings and gears.

Mr. A. MARSDEN (Bristol) said that it appeared that the "Connersville" type of meter had considerable possibilities for measuring crude gas. He would be pleased to hear whether any had been working under such conditions, and for a period sufficiently long, to allow of an opinion being formed as to their being generally suitable for measuring crude gas, water gas, or coal gas.

Mr. K. L. CLARKE (Weston-super-Mare) drew attention to the recent Presidential Address given by T. H. Prater to the London and Southern District Junior Gas Association, in which he described the use of a positive type blower on a water gas plant to obviate the noise associated with the usual turbo-blower. He (the speaker) would be interested to know how the steam consumption of the positive-type blower compared with that of a turbo-blower under these conditions.

Mr. D. E. GARLICK (Glastonbury) said he was interested in the question of gas dehydration in regard to the maintenance of consumers' meters. He had on his district a number of small high-capacity meters, some of which, though not unduly overloaded, gave a considerable back-pressure; and he would therefore be interested to know whether, by adopting gas dehydration, there would be a tendency to reduce the pressure absorption of these meters.

REPLY TO DISCUSSION.

Mr. WATSON, replying to the discussion, explained that in the consumers' "Tandem Connersville" meter the valve shunting the

gas from the "Connersville" to the diaphragm meter, or *vice-versa*, was operated by a diaphragm connected on one side to the inlet and on the other side to the outlet of the meter. This diaphragm was therefore subject to the differential pressure across the meter; and as the flow of gas passing through the meter was reduced, the differential pressure was correspondingly reduced, until a point was reached where the diaphragm fell, closing the shift valve connected to it through levers. Slip was determined in the shop, or *in situ* on the works, by a handwheel slip test, which briefly consisted of turning the impellers by hand against a closed inlet or outlet gas valve. The pressure between the impellers and the valve therefore rose, and the revolutions per minute to produce a given rise of pressure were an indication of the slip at that differential pressure when the meter was working. The slip geared into the counter was about 0·5 p.ct., and did not vary appreciably when the meter was working between 10 p.ct. of its rated capacity and 50 p.ct. overload. This slip did not vary in use, as the casings and impellers were of cast iron; and, as there were no internal parts in contact, no wear could take place internally. If the bearings or gears began to wear, the clearances internally could not increase sufficiently to cause undue slip, before the impellers would be either in contact themselves or scraping the casing, indicating that new bearings or gears were necessary. Under ordinary conditions the minimum life of gears and bearings was at least five years. "Connersville" meters could be used on crude gas providing the gas was reasonably free from tar. As an example, a "Connersville" meter measuring crude carburetted water gas had been in constant and satisfactory operation at the works of the South Suburban Gas Company for the past four years. The normal operating speed for "Connersville" exhausters was about 300 r.p.m. They could be worked as slowly as possible compatible with regulation by the standard hydraulic regulators. "Connersville" blowers on water gas plants were probably more economical in steam on the "blow," while the turbo-blower was probably more economical on the "run," so that the total steam consumption of the two was not greatly different. The "Connersville" blower, however, was much quieter. No figures were available for the reduction of pressure absorption of consumers' dry meters attendant upon installing gas-drying plants; but it was certain that the absence of corrosion on working parts and absence of condensate in the bottom of the meter casing would lead to much freer working.

Votes of Thanks.

A vote of thanks to Messrs. W. C. Holmes & Co., Ltd., for the loan of the films was proposed by Mr. Barrett, and seconded by Mr. G. C. Gunston (Bristol).

Mr. Watson, in acknowledging, stated that Messrs. Holmes would be pleased to loan these films to any engineers desiring to show them to their staff or workpeople.

The meeting then adjourned to the showrooms of the Bath Gas Company, where refreshments were provided.

Mr. J. T. Spencer (Weston-super-Mare) thanked the Bath Gas Company for their hospitality, and Mr. C. Bateman (Bath), in the absence of the Engineer and Manager, Mr. Whimster, replied on behalf of the Company.

Yorkshire Junior Gas Association

Presidential Address of Mr. J. W. Horwill

Saturday, Nov. 22, was President's day of the above Association, when nearly one hundred members met in Bradford, assembling at the Town Hall where conveyances were waiting to take the party to the Birkshall works of the Bradford Corporation.

On arrival at the works, Alderman George Walker, the Chairman of the Bradford Gas Committee, extended a welcome on behalf of the Gas Committee, saying how pleased they were to be able to receive the Association that day and expressing the hope that the visitors would find something of interest during the tour of inspection. Proceeding, Alderman Walker said they were gratified that Mr. J. W. Horwill had been elected President of the Association, and he (Alderman Walker) hoped that they would have a good session under Mr. Horwill's presidency. The members then proceeded round the works, after which they returned to the Town Hall, assembling in the Council Chamber where the Lord Mayor of Bradford, Alderman Alfred Pickles, was introduced by the President, who said the Association very much appreciated the Lord Mayor's kindness in giving of his time to be present at that meeting. Although the Association had met many times in Bradford this was the first time they had been privileged by having the Lord Mayor there to extend an official welcome.

The Lord Mayor said he would like to extend a welcome to Bradford, not only as the Lord Mayor, but as an ex-member of the Gas Committee. Remarking on his long connection with the Gas Committee, the Lord Mayor said he had been associated with Mr. Sutcliffe for many years. The Lord Mayor went on to relate an experience when a member of the Council had remarked that the street lighting of Bradford should be electric, similar to that in Market Street and Darley Street. When the Lord Mayor pointed out that the lights referred to were not electric but gas, the speaker doubted the statement which the Lord Mayor had made, but on examination of the lights was bound to admit they were gas—a point which proved that gas was far from being obsolete.

The President voiced the thanks of the Association to the Lord Mayor for his welcome.

PRESIDENTIAL ADDRESS

of J. W. Horwill, of Bradford.

The values of Co-operation and Co-ordination in connection with all classes of industry have, by reason of modern conditions, been more forcibly demonstrated during recent years and can, I think, be considered in relation to our own industry and affairs with advantage to all concerned. Such an Association as our own could not be carried on without active co-operation between the members, and I am pleased to say that throughout the period of my official connection with the Association there has always been present the desire to work jointly together for the common good and a ready willingness to harmonize our activities.

The Institution of Gas Engineers' Education Scheme is also an example of the application of co-operation, and although in some quarters the Scheme may not yet be regarded as perfect, we as a Junior Association are pleased to have been associated with the Senior Institution in the formation of what we hope will eventually be looked upon as the greatest effort ever made to improve the efficiency of those engaged in this important industry of ours. With the bringing into operation of the District Committees, all the machinery necessary for the Scheme functioning smoothly in this district has been provided, and one of the endeavours of our Association must be in the direction of leading new entrants to the service. Similarly the Association must welcome a Scheme embracing and providing for the salesmen and those engaged on the commercial side of undertakings. It is known that a great deal of anxious thought and consideration has been given to the provision of a scheme to meet the needs of these classes of officer, and there is reason to believe that in the near future the preliminaries will be satisfactorily concluded and a scheme launched.

Competition.

Most gas undertakings are to-day faced with the problem of combating intense competition, and whether we be in the works, on the district, in the showroom, or head office, and I might add in the Board Room, it behoves everyone engaged in the industry to take every opportunity, however small in itself, to assist in reducing costs and so enable us to meet our competitors on the best possible terms. Primarily the cost of our principal product must be made more advantageous to the consumer; he must be encouraged to make full use of the services we can render to him, and he is most likely to do this when our charges can be shown in a favourable light.

The first need of close co-operation is in the activities of the undertaking, especially with the larger units, where, owing to sectional arrangements, it is easy to concentrate on and develop our particular section without due regard to the undertaking as a whole. To the consumer coming into contact with more than one section, and each dealing with him as a separate unit, it would appear necessary for co-ordination to be applied; otherwise he may quite rightly think that our charges are unnecessarily swollen with redundant costs. Each section, efficient in itself, must be built up as part of the whole; co-ordination between sections must be conducted with full knowledge of each other in order to eliminate the possibility of wastage of time and labour, thus enabling us to give our customer the best possible service at the lowest cost.

Throughout the undertakings all should be imbued with the same endeavour to bring forward suggestions for improvements of methods; the cumulative effect of quite small improvements may be considerable, and each one of us can do something to increase the efficiency of that part of the work entrusted to us. Associations such as ours keenly desire to inculcate the spirit of efficiency and good service, and I hope such objects will never be lost sight of. Let us do everything possible to improve our knowledge of the job in hand, so that we may render full value for the remuneration received.

From time to time the question of remuneration in the industry has been ventilated and brought forward for discussion and consideration, and as Juniors it is a subject in which we are deeply interested; but until more active co-operation throughout the industry is rendered possible, I cannot see how much can be done to bring the matter into proper perspective. In recent years there has been a marked and noticeable improvement in the young man offering himself to the industry, and it should be a necessary corollary that the remuneration offered should be adequate and suitable for the qualifications and services rendered; but I am afraid this is not always found to be the case. The Junior Associations should let it be known on every possible occasion that in their ranks are men of ability

with the necessary qualifications awaiting opportunities of demonstrating their capabilities in positions higher than those they now fill, and that their reward should be a proper and reasonable rate of remuneration.

Superannuation.

While on this subject, I note with interest that the question of superannuation has recently been referred to in the Technical Press. Those of us who are fortunate in being in the service of a municipality wise enough to avail themselves of the provisions of the Local Government and Other Officers' Superannuation Act, 1922, have already realized the benefits to be derived from that measure, and we should like to see an extension of the facilities of the Act in order to cover all our colleagues throughout the industry. Some companies in the Kingdom have their own pension schemes, but for the others it would appear that some national scheme must be evolved, and how soon such a scheme is launched will largely depend upon the co-operation of those desiring the facilities. I should remind the members that many years of active propaganda, entailing much hard work, was necessary before the Act of 1922 was placed on the Statute Book, also that the Association responsible for the preparation and presentation of the measure,

THE PRESIDENT.

J. W. Horwill.

Mr. Horwill is Commercial Assistant to the Bradford Corporation Gas Department, having entered the service of that Authority direct from school, and passing through various sections of the Department prior to being appointed to his present position. He served the Association as Honorary Secretary for several years, and vacated that office on being elected Vice-President two years ago. Mr. Horwill has for many years been closely connected with the activities of the National Association of Local Government Officers, being Chairman of the Bradford Branch; and he is also Chairman of the Health Insurance Approved Society of the Local Staff Association.

and also its passage through the legislature, needed to show solidity in their desire for it and their force as a body that could not eventually be disregarded. Under the 1922 Act Joint Schemes are functioning and catering for the officers and servants of many Urban and Rural Councils not each in themselves large enough to carry a separate scheme, and such facilities could no doubt be made available for the smaller gas companies in the event of superannuation being extended to public utility undertakings. Superannuation is undoubtedly an advantage to be desired both by employees and employers, but up to now the appropriate body to deal with it has not been found in the industry, although spasmodic references to the need have been made. I have wondered why for so long the staffs of public utility undertakings have remained independent of their colleagues in municipal service when both sections are working in the common interest of public service, and should consequently be governed by similar conditions.

There is ample opportunity for co-operation between undertakings in districts, and during recent years several joint schemes dealing with the selling of residuals have been brought into operation. These may, I think, be regarded as examples of what can be done to ensure that the best financial returns may accrue to the industry.

The Co-operative Tar Schemes initiated a few years ago are proving to be of incalculable benefit to gas undertakings, and give evidence of successful joint working arrangements with a product which has not always been dealt with in a manner satisfactory to the undertakings—that is, the fluctuations which are encountered in the markets for tar products have always been liable to create a feeling with both the distillers and the producers that better financial results should be shown, and with the entry of other producers and the importation of bituminous preparations, this uneasiness was bound to be attenuated. I am afraid that in times of depression in the tar products markets—and there have been worse periods than we are now experiencing—undertakings have been obliged to accept unduly low prices for their tar. Therefore, the inception of the Co-operative Schemes, with a combination of mutual interests both on the producers' and distillers' sides, for the common good, has proved advantageous to all parties, and the experience now being gained will no doubt ensure a continuance of this method of marketing our tar over an extended period. In Yorkshire we have every reason to be particularly pleased with the results achieved, and can claim results as good as any other similar scheme in the country.

Coke Disposal.

With very few exceptions, undertakings now send out coke just as required by the consumer; gone are the days when, for instance, we had only one size. Competition in the coke market has certainly had a stirring effect, and has been the means of stimulating our efforts for the general good, while the extra costs entailed by decreasing the ash content and in grading and bagging, all of which are now absolutely essential, are repaid by the increased revenue which the product demands. It would be ideal if each undertaking could sell all its coke in its own area; and the domestic trade in small quantities, while perhaps not in itself as remunerative as sales in larger quantities, is now so highly developed as to play an important part in the local disposal of output in most places. There are, however, still isolated cases where the problem of dealing with tonnages over and above the local demand in inland towns and also surpluses of some coastal towns has to be met. Dumping into other areas at specially cut prices may relieve a particular undertaking, but such methods cannot be regarded as satisfactory or to the common good, and can only be resented by the undertakings who find their territory infringed upon.

Although many of the undertakings in this part of the country are faced with heavy railway rates and other handling charges to the nearest ports, it is still possible for us to compete in the export market, and it is in this direction that a solution of the sulplus coke problem is to be found. This view is confirmed by the Yorkshire Commercial Section of the Manchester Institution, and that body two years ago set up a Special Committee entrusted with the duty of disposing of all coke available for shipment from the district, and so far the work done by the Committee has been regarded as satisfactory by all concerned in the movement. Under the arrangements, undertakings report the quantities available and the period in which they require to send; information is collated showing the different qualities, according to the type of carbonizing plant from which the coke is drawn, approximate ash content, and the varying cubic measurements of the fuel. All inquiries from exporters are referred to the Committee, who are in a position to submit prices which are in relation to each other, bearing in mind the handling charges between each works and the port and the general market conditions. By such methods it has been found possible to cut out much of the speculation which formerly existed in the export market and obtain fair prices for the undertakings.

Previously, I am afraid, market prices were very often depressed by parcels being offered at low figures in order to clear stocks at a small works, and although these sales were only for small tonnages, they were used against the sellers of larger quantities. The exporters have also benefited by arrangements which enable them to buy direct instead of through middlemen and to eliminate the need to send out inquiries to a range of undertakings in order to fit their tonnages. Previously it may have been necessary for them to communicate their requirements to a dozen or so undertakings. It may be that at some future date it will be considered desirable to extend the scheme to embrace all the arrangements between the works and the foreign buyers; but the ramifications and interests involved combined with small margins of additional profit suggest that this may only be done with advantage by a unit larger than the District.

Coal Buying.

To carry the spirit of co-operation still further, I turn to our relations with the sellers of our raw material. We have heard

much in recent years of the desire of coal owners to sell to us at economic prices, and if both sides could agree on a basis which would give all an economic price, it would be to the general good. The gas industry awaits with particular interest the developments foreshadowed by the Coal Mines Act, although we in Yorkshire have had experience of the voluntary scheme operated by the Central Collieries Commercial Association, whose activities have been used as the basis for the section of the Act with which we are principally concerned. The question of price for gas coal must entirely depend on the contents of the coal, and if prices are to be increased, we shall need to be much more stringent in our methods of assessing the fair value to us, bearing always in mind our duty to the gas consumer and the relation between our products and those of our competitors in the lighting and heating world. I can foresee a keener demand for a reduction in the ash and moisture content of the coal we carbonize, and to attain this one can readily perceive that the special knowledge obtained by some of the undertakings in a district will be of inestimable value to the whole. The knowledge derived from regular testing on a full working scale will be valuable for all, and the general adoption of conditions governing the non-productive contents of the fuel and the thermal yield will come to be essential points in our contracts.

When speaking to the Association two years ago, my Chief (Mr. E. J. Sutcliffe) mentioned that Bradford had then contracts containing an Ash-Content Clause, and after this extended period it may be stated that such a clause has been of benefit to the Undertaking. If the various undertakings got together and pooled their information, I think it should be possible to prepare a scale of values covering the various classes of fuel available to us and providing a basis on which prices to the various undertakings could be fixed.

In referring to the coal owners I am reminded that we have for a long time found our interests to be closely attached to theirs in other ways than the buying and selling of coal, and with the extension of coke oven plants we are more than ever meeting them in the coke and tar products markets. More recently still their desire to be regarded as gas producers has been demonstrated, and in these days, when elimination of all wastage is more than desirable—even absolutely essential—it is hoped that an amicably framed working scheme will arise from the report of the Area Gas Supply Committee on what has come to be referred to as the "South Yorkshire Gas Grid." The developments now in hand for carrying out the recommendations of the Committee provide a suitable opportunity for close co-operation between the gas undertakings now supplying within the area of the grid, and we as Juniors were pleased to find that as a result of the evidence put forward, the industry was to be provided with the opportunity of carrying out the recommendations of the Committee.

It may be that the South Yorkshire proposals will cause fuller consideration to be given to joint working arrangements in other parts of the country, and perhaps future legislation will provide some simpler methods for facilitating amalgamation of interests, and pave the way for consolidation on voluntary lines, rather than wait for national action with compulsory schemes subjected to Government control. The grid scheme of the electrical industry points the direction of modern thought, and although the Government aid has in many ways benefited their industry (it has certainly given them undoubted advantages in addition to booming and publicity), much could have been done on voluntary lines to attain the same end. In this part of the county, where over a large territory our respective areas are contiguous to each other, it should be possible, by linking up the network of mains, to ensure that the most efficient and economically worked gas producing plants in the district could be kept in work to their full capacity before further capital expenditure is incurred in various places on new plant which is fully required only during peak load times. Until we reach that stage when, by increased all-the-year-round sales, we can keep our plants working to full capacity, there must be under independent working a large amount of stand-by plant brought into use for only comparatively short periods of the year. A scheme of joint working would probably bring us nearer to a closely co-ordinated system of charging, whether it be per thousand, per therm, or per unit, whereas at present we have so many and such varied methods in operation that the moving consumer is bewildered. Is it too much to ask you to visualize that at some future time the undertakings in given areas will be linked and functioning for the general good of all, and not as separate units?

Advertising.

Co-operation in advertising could quite usefully be extended so that fuller advantage could be taken of those mediums circulating over large areas. Most newspapers now claim wider areas of circulation, and the tendency is to make them still wider. We are all agreed that the need to keep our services and activities before the public was never more necessary than at the present time. Even municipal undertakings must admit this need; and while the British Commercial Gas Association are entitled to the gratitude of the industry for what they do with the limited funds at their disposal, there are many opportunities presented where combined efforts can be utilized as supplemental to and in conjunction with the Association's plans. An individual undertaking's advertisement displayed in a publication circulating in another undertaking's area may not appear well in the eye of the reader and consumer, and such could be made much more forceful if prepared on co-operative lines.

From the preceding remarks you may quite imagine or infer that beyond the districts or areas, co-operation is not essential. Far from such a thought, there is the need of national bodies, but I would regard these as being more desirable for co-ordinating and harmonizing the activities of the districts. Every incentive should be left to the individual undertakings and to district bodies to develop to the fullest the opportunities for joint action; but, as I suggested earlier in my remarks, when dealing with coke for export, where it is necessary to seek a bigger unit, then the national co-ordinating unit should bring together all the district interests.

We were informed in the spring of the year that National negotiations to deal with exported coke had taken place; but it would appear that either the proposals put forward or the time of their appearance was not right. If the Yorkshire experience can be taken as a guide, there is room for a National movement to ensure that gas undertakings retain their share of the foreign coke trade. It may just as likely be that the various Co-operative Tar Schemes could be brought together to the ultimate good of all participants. Similarly, co-ordinated policy could be adopted for guidance of districts to cover coal buying arrangements, methods of charging for gas, and other matters of common interest.

Votes of Thanks.

Mr. J. W. Holroyd (Elland), Senior Vice-President of the Association, proposed, and Mr. J. W. Wood, M.Sc. (Leeds University), Junior Vice-President, seconded, a vote of thanks to Mr. Horwill for his address, which was unanimously carried with applause.

The members then adjourned to the Banquetting Hall for tea, when Mr. A. Wylie (Sheffield) proposed a vote of thanks to the Bradford Corporation Gas Committee, the Chairman of the Finance Committee for allowing the use of the Council Chamber and Banquetting Hall, the Chairman and Deputy-Chairman of the Gas Committee, and Mr. Sutcliffe, the Engineer and Manager, for the admirable arrangements made for the meeting that day. Mr. C. H. Chester (Wakefield) seconded.

In acknowledging the vote of thanks, Alderman Walker said that there was a big future for gas, and such meetings as that would do a great deal to further their efforts. He congratulated Mr. Horwill on his address.

Councillor Cowie, in associating himself with the reply, said this was the second occasion on which he had met the members of the Yorkshire Junior Gas Association, and he sincerely hoped it would not be the last. He, too, complimented Mr. Horwill on his address.

Scottish Junior Gas Association (Western District).

Visit to Coatbridge Gas Company.

On Saturday, Nov. 15, over a hundred members of the Association visited the works of the Coatbridge Gas Company. The visitors were received by Mr. Murray, Director, and conducted round the works by Mr. Alex. Jamieson, Assistant Manager, and other members of the staff. The works were described fully in the "Journal" last week.

After inspection of the works, the members were entertained at tea in the Town Hall. Mr. A. S. Leggat (Chairman) and Messrs. Miller, Denholm, Davie, and Murray (Directors), Mr. George Braidwood, Engineer and Manager, and Mr. Jamieson were present.

Mr. Leggat, welcoming the visitors, said that this was the third occasion on which the Company had had the honour of entertaining the Juniors. The first time was over twenty years ago, when Mr. Braidwood was the Secretary of the Association.

Mr. D. Melvin (Uddingston), President of the Association, said that the Coatbridge Gas Company had always willingly thrown open their works for their inspection and education. He asked Mr. Leggat to convey to his fellow Directors the best thanks of the Association for the privilege accorded to them that day, and for the hospitality provided. He also thanked Mr. Braidwood, Mr. Jamieson, and the staff for the arrangements made and for the way in which they had been conducted through the works.

Mr. Braidwood expressed his pleasure at having the Juniors at Coatbridge. He contrasted the visit of 22 years ago with the present one. The works, he was proud to say, were progressive. In 15 years the output had increased from 179 millions to 315 millions. In Coatbridge there was not a single public lamp using electricity, which showed what could be done with gas lighting.

Scottish Junior Gas Associations

Joint Meeting of Western and Eastern Districts

The first Joint Meeting for session 1930-31 was held in Edinburgh at the Gainsborough Hall on Nov. 8. Mr. D. Yule, of Alloa, the President of the Eastern District, occupied the chair, and was supported by Mr. D. Melvin, of Uddingston, the President of the Western District.

Mr. YULE welcomed the members of the Western District. It was, he said, eight years since the first of their joint meetings; and these meetings had served to link up the junior members of the industry in Scotland in closer relatioinship in the prosecution of the aims of the Association.

"GEOMETRY JOYS" AND "SOME METALS."

By DAVID WARDEN, of Dundee.

I wish to consider a particular branch of the science of geometry with which I am brought in close contact during the discharge of my duties in the Dundee Corporation Gas-Works. I refer to surface development, used largely in the production of sheet metal work; and, in the particular examples I wish to bring to your notice, the development required for some curiously shaped flues in connection with gas appliances fitting. The first instance concerns the flue arrangement required for two Rudd circulators. These appliances were fitted for the Dundee Football Club at Dens Park when their new arrangement of players' baths, &c., was fitted. The water fitting was done by a local plumber, and the intermediate tanks, two in number, were made of copper by a local firm. The gas fitting and flue pipe work was done by the Dundee Gas Corporation. A mutual flue was fitted, in shape rectangular. This design was necessary because the flue had to be fitted into one of the iron sections supporting the floor of the grandstand, and carried to the outside air to a wall ventilator of our own design. The section mentioned was situated a considerable distance from the circulators, and in position much to one side. I found it necessary to give the rectangular main shaft a twist of 45° to the right in order to avoid the copper pipes leading from the cold supply cisterns. Proceeding onward with the flue pipe, the passage was obstructed by an angle-iron found on the galvanized iron sheet which formed the back cover of the erection. This angle-iron being directly in the way of the flue, another special development was required. This consisted of a section of the flue turned in a complete twist, with the added difficulty of having a flush back. Other examples of the intersection of solids could be taken from this job.

The weight of metal used on this work was 20WG galvanized; the pipe was in 3-ft. lengths with knocked-up joint and slip joints for each length, the inside of the pipe being coated with bituminous paint. That part of the pipe laid into the section was separated from the section by a wooden strap, so that the body of metal in the section would not influence the function of the flue. This proved to be a very satisfactory job, the architect commending the arrangement and work.

Another curious development required for fluepipe work was that of two gas fire fittings, these being fitted for another Corporation Department in Dundee. In this instance a brick flue was built (not to the Gas Department's instructions) to accommodate the flue outlet of the fires. The type of fire used was the "Times," having a long narrow flue with straight sides and semi-circular ends, in size about 16 in. by 2¼ in. The size of the flue which had been built was 4 in. square. It was necessary to make a connecting piece. As in the other instance, the development was done by means of triangulation. This has also proved to be a satisfactory job.

A large textile firm in Dundee had decided to install a plant for the purpose of waterproofing cloth, and the engineers in their own employ erected the necessary machinery. This included a pot or bath under which were fitted very powerful gas burners of the baking plate type. On examining the appliance for flue arrangement, it was found necessary to build out commencing piece into the brickwork. The piece was rectangular, and in order to clear an obstruction it was necessary to alter the shape of the flue from rectangular to round with a flush back. This work has also gone on without complaint.

Some years ago we had to deal with a very curious and annoying problem, which also had a connection with a waterproofing plant in a large bag factory in Dundee. This factory is three stories high, the proofing plant being situated on the ground floor. The boiler or pot in which the bitumen is melted is gas fired, as is the machine on which the actual process of proofing takes place. On the first floor a number of very clever machines are to be seen—sewing, rivetting, cutting, &c.—and this floor is heated by means of hot water radiators, the heat source being two circulators situated in the ground floor beside the plant already mentioned. These circulators are also gas fired. My difficulty here was with the flue pipes of the circulators. The Dundee Gas Department did not do any part of this work in its original state. On making an examination of the job, I found that in the basement where the appliances were fitted the only means of ventilation was a rectangular hole about 18 in. by 6 in. cut out of the top style of the only door in the basement workroom. To comply with the Board of Trade regulations, a suction fan was fitted to a long sheet metal stack to which was attached a canopy over the bitumen melting pot. Mutually connected to this canopy pipe was another flue leading to another canopy fitted over the bitumen in the tank of the machine through which the cloth passed as it was treated. This fan had a very powerful pull. If the door of the room was opened while the fan was in operation, it was a difficult matter to close it again so long as the fan was working. The canopy over the bitumen pot was conical in shape, and the gasfitter who put in the flue pipe for the circulators fitted them so that the products of combustion were discharged into the large diameter of the canopy. This was a very unwise procedure, because the extraordinary conditions created by the fan caused excessive condensation from the circulator flue pipes. This choked the circulators with corrosion and was altogether a very unsatisfactory job. To give some idea of the amount of condensation, I would say that a branch was taken from the flue pipe to an outside run off; and so great was the condensation at the canopy end that buckets were placed round its large diameter to prevent the water running into the bitumen boiler and ruining its contents.

I had all the existing flues taken down, and fitted each circulator flue independent of the other. These pipes were led into a double "Kingsway" wall ventilator which the mason fixed to the outside of the building. The products of combustion were therefore led to the outside air; and the system worked very well until the fan was put into operation, and, as I expected, the gas was very promptly "drawn" out. A cut-out was next made, and fitted to each pipe. This was used while the fan was working; and when the fan was stationary the cut-out was drawn, and the flues worked under normal conditions. A model of this cut-out will be shown to you later. The galvanized sheet-iron flue had to be renewed in part each season. The consumer was quite willing to bear the expense, and he allowed us to fit "Everite" flue pipes. These have been in now for five years, and are still good. I could give other examples of jobs where this type of flue has been used with good results.

In Dundee we have a consumer for whom we have done a large amount of gas fitting work, both at his places of business and at his private home. This man lately built a new cinema. The Dundee Gas Department fitted out this theatre with gas radiators, fires, &c., all flues being made of sheet metal. One gas fire was fitted in the chief's office, and he desired a flue of a different design from the usual round or oval shape. Here we fitted a diagonal flue. This makes a very neat job, easy to set out and pleasing to the eye.

A WONDERFUL DISCOVERY.

Sir Jagadis Bose, the great Hindu Scientist, has demonstrated that steel and other metals can feel. Diagrams from galvanometer tests show the resemblance between metal and muscle; in each case the sensations grow less under repeated irritation. He also proves that metals have an affinity for poisons, in being affected by stimulants and narcotics in the same manner as a human brain would be under the same influence. A human brain under the influence of bromide goes to sleep. Our scientist gave a dose of bromide of potassium to an ingot of tin, with the result that it lost a great deal of its sensitiveness.

Surface treatment of metals is necessary for various reasons. We have examples in the case of iron as used by the sheet metal worker. Surface treatment may be to preserve the metal, to beautify it, or to prevent poisonous effects—such as the tinning of copper cooking and domestic utensils. An example of the last is provided by the soup boilers used by the Dundee Education Authority in their various school cookery kitchens. Gas is used in many ways in these schools, both for demonstration to students and for cooking. In the most up-to-date schools dining rooms are provided. Most of the soup boilers used in the kitchens are of the copper pan type; and it is the usual custom during the summer vacation to have as many of these boilers sent in to us as require repairing and re-tinning. This is done in our own workshop, the boilers being thoroughly overhauled. New bottoms are made and fitted where necessary, new galvanized outer shells are fitted, and each pan is re-tinned with pure tin. This year we are trying an experiment in this work by making and fitting to an ordinary frame a stainless steel pan. This metal is reputed to possess all the virtues necessary for work of this kind, is specially resistant to corrosion and heat, and will not poison food. Surface treatment is therefore unnecessary. This circumstance will perhaps save our consumer trouble, reduce

maintenance charges, and probably convince him of the efficiency of gas for cooking.

I was rather diffident at first in using this metal, but I found it to be fairly easy to work in the usual sheet metal practice of knocking-up, flanging, wiring, &c., the only difficulty experienced being that of soft soldering. This has been overcome by using a special flux prepared by Canning & Co., of Birmingham. We have made other articles of this metal to replace ones in which corrosion has been frequent.

Discussion.

Mr. MELVIN said: My first duty is to thank Mr. Yule for his words of welcome to those of us from the West. These Joint Meetings are, I think, the best items in the sessions' work. Mr. Warden has confined himself to three dimensions, although probably the fourth—time—comes in once the jobs are finished. Should not a flue pipe terminate above the level of the roof? I notice that in one case quoted the flue terminates in a wall ventilator. Does this ventilator work equally well with the wind blowing directly on it?

Mr. WARDEN: After fixing a "Kingsway" ventilator we make it a practice to watch whether the weather is unfavourable to ventilator conditions, and to pay our consumer a visit in order to inspect the appliance and observe its performance. In 95 p.ct. of our problems no further modification is required.

Mr. YULE asked where Mr. Warden would suggest the "Kingsway" ventilator should be placed in relation to the gas appliances. He presumed it should be in the vicinity of the eaves of the roof. At one of the Alloa Town Council Housing Schemes, completed four years ago, gas fires had been fitted in the bedrooms, but there were no flues. The ventilating arrangement consisted of a port which led diagonally upwards to the outside wall and terminated with an iron grating only a little higher than the gas fire. Did Mr. Warden think that by replacing the iron grating with a "Kingsway" ventilator all conditions of wind resistance would be successfully met? The remedy suggested by the Gas Department, and carried out as a trial on several houses, was the erection of a "Urastone" flue pipe terminating with a suitable cone cap at a point nearly level with the ridge of the roof. Only in this way did he think that an assurance of satisfactory results under all conditions could be given.

Mr. WARDEN said that, judging from his experiences, quite satisfactory results would be obtained by placing the ventilators in the same position as the gratings, but regard must be paid to possibility of damage by children and to the relative position of windows.

Mr. R. KEILLOR (Greenock): Has Mr. Warden had experience in working heavy plate metal? I have seen some work of this nature in a sugar refinery, where the metal was valuable. To ensure as little loss as possible, the method of finding the desired surface was to make a wooden template the required solid, cover this with sheet lead, unfold it, and use it as a pattern. Would Mr. Warden use this method? To what kind of stainless steel does the author refer? What would be the cost compared with ordinary metal? With reference to the "Kingsway" ventilator, does it function as well in the case of downdraught as does the "Brassington" type?

Mr. WARDEN: I have had experience in working heavy plate metal of different natures. I have not seen the method described by Mr. Keillor for striking out a surface development. It is important in plate work that the thickness of metal is not neglected when setting out a surface. The correct principles and properties of the required object being first understood, consideration must next be given to the neutral axis, this being the line in a bent bar or plate which will remain unaltered and from which definite measurements may be determined. The metal in question is Firth's "Staybright" steel. The cost is considerably more than that of ordinary metal sheet. This may perhaps be balanced by the durability of the metal, and in the actual case mentioned—namely, soup boilers—by the fact that the metal will not at any time require surface treatment. I was familiar with the "Brassington" type of ventilator 25 years ago. It is a good type, and is designed to operate on a pipe, the head being in a horizontal position. The "Kingsway" ventilator is a wall ventilator designed to work in a vertical position under the most severe weather conditions, and it has satisfied all concerned regarding its reliability. It is my opinion that no apparatus has yet been designed to reproduce all the natural conditions under which flues and ventilators work.

Mr. A. BUJNOWSKI (Glasgow): In Glasgow we are sometimes troubled with down-blow at gas fires. Will the "Kingsway" ventilator function properly under the eaves of a dwelling house? Can Mr. Warden give some idea as to the life of an ordinary light copper pan type of wash-boiler?

Mr. WARDEN: The "Kingsway" ventilator is specially designed to work under the condition mentioned. The existing iron grating must be first removed, and great care must be exercised to note that the injector part of the ventilator is fitted clear of the rain-water conductor pipes. When these pipes are met, the depth of the ventilator must be increased to clear the obstruction. The ventilator was originally made to overcome a fault in existing systems. The Dundee Gas Department did not design the system, but they endeavoured to satisfy consumers' complaints in this respect. In Dundee we fit wash-boilers in tenement wash-houses on the slot meter system. These boilers get very hard usage. The ordinary copper pan of 22 W.G. will have useful life for about five years under those conditions, without repair other than ordinary maintenance. In ordinary domestic use—*i.e.*, one boiler to one consumer—a much longer useful life may be expected.

Mr. F. MITCHELL (Dundee): Can Mr. Warden give some information regarding the use of "Staybright" steel in the chemical department of a gas-works?

Mr. WARDEN: In the Dundee Gas-Works a piece of sheet "Staybright" steel was placed in the saturator at the sulphate house. It was hung by a piece of No. 10 iron wire, and the wire was eaten through in one week. The metal was then hung by a strip of "Staybright" steel; and at the end of one month it was taken out and found in good condition, though discoloured. We have displaced tinplate jugs used in the laboratory by others made of "Staybright" steel, and up to date the report regarding their condition is good. Having the assurance from the agent of the metal that there is no electrolytic action in using the metal, it has been decided to fit to our existing copper drying basket an inside lining of "Staybright" steel.

Oriental Gas Company, Ltd.

ANNUAL GENERAL MEETING

The Annual General Meeting of the Company was held at the London Offices, Finsbury House, Blomfield Street, E.C., on Wednesday, Nov. 19—Mr. STANLEY H. JONES, M.Inst.C.E. (the Chairman), presiding.

The SECRETARY (Mr. S. Rainer) read the notice convening the meeting and the report of the Auditors; and the report of the Directors and the statement of accounts for the financial year ended June 30 last were taken as read.

The CHAIRMAN: The accounts we present to you to-day cover a period during which political unrest in India has seriously affected the trading conditions there; and we may, I think, be thankful that the Company has been able to maintain its position as well as it has. There appear to be signs of the political situation improving, and this will, we must hope, result in an improvement in the trade and commerce of India. I regret to say little or no progress has been made in the negotiations with the Corporation of Calcutta in regard to the substitution of a heating value test of our gas for the obsolete illuminating power test that has been in force so long; but possibly the political situation in India has delayed matters. There are, however, signs that the Corporation are again turning their attention to the subject.

ENGINEER'S RETIREMENT.

You will, I know, share the regret that the Directors feel that, owing to ill-health, our Engineer and General Manager, Mr. Snelgrove, found it necessary to retire in the spring of this year from the position he has held so long and with such credit to himself. Mr. Snelgrove, who joined the Company's service as Distributing Engineer in 1909, has been for eighteen years our chief officer in Calcutta, and he carried out the duties of his position with conspicuous ability and success. We owe him our best thanks for work well done; and in the circumstances you will, I am sure, be glad to know that the Directors have made him a suitable retiring allowance, and will share their hope that relief from the burden of management and change of climate will soon restore him to better health. We have appointed as his successor Mr. Garsed, the Assistant Manager, who has been in our service ten years, and whose work has given us great satisfaction.

THE ACCOUNTS.

With regard to the accounts, we have made no charge against capital during the year, and the capital expenditure per million c.ft. has been reduced to £734, as compared with £745 the previous year. As regards the revenue account, coals cost £45,488, as compared with £40,378. The coal carbonized was 53,752 tons, as against 49,297 tons. Repairs and maintenance of works were £19,347, as contrasted with £27,941, a reduction of nearly £8600. The expenditure on mains and services was £10,081, as compared with £5463, this large increase being due to the laying of a considerable length of feeder main to the southern area of Calcutta, to improve the pressure of gas in a rapidly developing district. Fittings and stoves expenditure was £5177, against £2894. For this there are several reasons. For one thing, we have, as is customary with gas undertakings, been giving a little more free attention to consumers. It is good in the long run to do this. Rent, rates, and taxes were £10,285, as compared with £7085. Management charges were £11,268, against £11,063. Superannuations were £880, as compared with £322, the increase being due to a gratuity granted to our late Mains Superintendent, Mr. Bacon, on his retirement from our service in April last. On the receipts side of the revenue account, gas rental was £126,601, against £124,229; meter and stove rentals were £6167, against £5600. The residual products receipts were £22,105, against £20,495. The balance of profit is £24,377, as compared with £27,452.

Turning to the net revenue account, bank interest was £1057, as against £1378; interest from investments was as before, £574; exchange was £6080, as against £6695. The balance available for dividend is £83,411, out of which we recommend the payment of a dividend at the rate of 4½ p.ct., less income-tax, making, with the interim dividend of 3½ p.ct., less tax, paid in May last, 8 p.ct., less tax, for the year. The reserve fund remains at the same figure. The depreciation account, renewals, suspense account, and exchange

equalization account remain as last year. We sold 25,525 tons of coke, as compared with 22,359 tons in the previous year; 1585 tons of breeze, as against 1906 tons; 697,299 gallons of tar, as against 467,772 gallons; and 280 tons of sulphate, as against 249 tons. In the balance-sheet amounts due by the Company were £14,580, as contrasted with £12,995. The loan from the bank on June 30 was £13,930, as compared with £21,520 in the previous year, a gratifying reduction of about £7600. Cash at the bank and in hand was £2506, as compared with £3149. Investments are as before, £19,657, the market value (£14,482) being slightly higher than last year. Amounts due to the Company were £6583, as against £6983.

Conditions in India.

We have carried out a good deal of re-arrangement work on the condensing, washing, and purifying plant of our Sealdah Works this year, in order to improve the working of the station; and this is now practically completed, with very satisfactory results. Mr. Garsed, our Manager, reports that our works and plant have been maintained in good and serviceable condition. He also states that relations with our employees have been amicable, and our association with the Public Authorities satisfactory. He concludes his report with some remarks on the state of things in India to-day which have so impressed me that I should like to repeat them to you. He says: "India to-day is in the melting-pot, so to speak, and of the future no one can speak very confidently; but we can only carry on conscientiously and with a determination to serve faithfully all round, and so endeavour to hold up our end successfully." Now, that is the right spirit in which to face the difficulties confronting us, and, whatever the future may have in store, in living up to such a resolve we shall be happy in the knowledge that we have done our best. There will, as usual, be a vote of thanks to our staff; but I feel I must pay a personal tribute to them, especially on this occasion, when the times have been so trying for those in India. Mr. Snelgrove, our late Manager, I have already referred to; and to his successor, Mr. Garsed, and those with him, I would say that his and their work has given great satisfaction to the Directors, and we congratulate them on the successful results of their efforts. I hope Mr. Garsed will be given health and strength to enable him to carry out his new duties for a long time to come. To Mr. Rainer, our excellent Secretary, and his small staff, I would tender my personal thanks for all they do so well.

I beg to move the adoption of the report and accounts.

Mr. Bertram W. Ellis, Assoc.M.Inst.C.E., seconded the motion, which was at once carried unaimously.

Dividend and Re-Elections.

On the proposition of the Chairman, seconded by Mr. W. G. Bradshaw, C.B.E., it was resolved to pay a dividend at the rate of 8 p.ct., less income-tax for the year, less 3½ p.ct., less tax, paid on account in May last.

The Directors retiring by rotation (Messrs. B. W. Ellis and B. M. Gill) were re-elected on the motion of the Chairman, seconded by Mr. H. H. Macleod; and the Auditors (Messrs. S. W. Savage and F. J. Bradfield) were re-appointed, on the proposition of Mr. D. H. McLauchlan, seconded by Mr. S. Rainer.

Mr. Ellis proposed a hearty vote of thanks to the staff of the Company in Calcutta and London. He said that Mr. Snelgrove, who had returned from India, was now out of this country, or would certainly have been at the meeting. He left the Company at the close of the last financial year in June, and his place had been taken by Mr. Garsed, who had done a great deal of valuable work since that date. With regard to Messrs. Savage, Smith, Morrison, Bathgate, and Pope, the cordial thanks of the Company were due, for having carried out their duties so well. In London, Mr. Rainer and his assistants had fully maintained their usual high standard.

Mr. Basil M. Gill seconded the vote, which was cordially passed and briefly acknowledged by the Secretary.

Extraordinary Meeting.

An Extraordinary General Meeting followed, at which a lengthy resolution was submitted for alteration of the Articles of Association of the Company, in terms of which shareholders had been duly advised.

The Chairman explained that the proceedings were really formal, the alterations being designed to bring the Articles into conformity with the Companies Act, 1929. He did not propose to go through them, but would remark that the most important change was to enable them, should they determine to issue preference shares at any time, to do so, if thought fit, on the terms that they are, or at the option of the Company are liable, to be redeemed. He moved that the Articles of the Association be, in accordance with the resolution, revised in conformity with present-day legislation.

This was seconded by Mr. Ellis, and at once agreed to.

LEGAL INTELLIGENCE

Nottingham Gas Conspiracy Charges

Nine Defendants Accused—£63,585 Involved

After several adjournments necessitated by exhaustive examination of accounts, the further hearing of charges in relation to conspiracy to defraud and stealing money belonging to the ratepayers was proceeded with before the Nottingham Magistrates on Tuesday, Nov. 18, when eight of the nine defendants implicated surrendered to their bail. One of them, Henry Rowland Deeley, aged 55, described as a merchant, was unable to appear through illness. The other defendants, in addition to Deeley, are Leonard William G. Ball, aged 42, who had been for over 20 years engaged in the Gas Engineer and General Manager's Department, latterly as chief of the clerical staff; Walter Ball, 56, manager to a large local firm of plumbers' merchants; Harry Wright Gardiner, 53, ironmonger; John Ernest Allen, 47, a builder; Frank Mullis, 68; Henry Flint Scotton, 47, timber merchant; Percy Sisson, 30, master plumber; and his brother Alfred Sisson, 44, also a master plumber. Deeley was present on Wednesday—the hearing being continued on that and the following day, when there was again a postponement of the investigation.

Mr. A. Ward, of Birmingham, and Mr. A. R. Flint, of Derby, barristers, appeared for the prosecution; and for the accused the legal representatives were Mr. A. M. Lyons, barrister, for Leonard Ball, Mr. R. A. Young for Allen, Mr. A. H. Davis for Walter Ball, Mr. S. J. Burnie for Deeley, Mr. H. Bradwell for Gardiner, Mr. E. E. Eccleston for Scotton and Mullis, Mr. E. W. Humphreys for Alfred Sisson, and Mr. W. Scott for Percy Sisson.

Case for the Prosecution.

Mr. A. Ward, whose speech in opening the cases occupied three-and-a-quarter hours, said that the prosecution had only taken typical examples. There were 42 charges in all involved in the various cases of the nine defendants, and in the whole of these Leonard Ball figured. Ball's salary was about £300 per annum, and it had been found that he owned 51 houses, two shops, and a motor-car; and his wife owned another car. In addition, he had made substantial advances to relatives and had had a house built for himself at Radcliffe-on-Trent costing over £3000. The larceny charges involved stealing public moneys. In the investigation of the accounts of the department, which had been made by Mr. C. J. Pain, Chartered Accountant, a period of ten years had been covered; and cases for the purpose of the prosecution had been taken dealing with recent frauds only. Leonard Ball was held to have been responsible for larceny in every case, as also of conspiracy in each instance with others of the accused. Ball, who had earned advancement in the gas office, had been regarded as a man in whom every confidence could be placed. It was suggested that others would also one day have to go into the dock.

Dealing with the Gas Department, Mr. Ward said that it had been run on very successful lines under the management of Mr. John Wilkinson, who had held the position for 19 years. Counsel explained the course of procedure in regard to the ordering of goods. Ball was a junior clerk in the general office when Mr. Wilkinson took up his duties in 1911, and in 1916 he had worked his way up to become order clerk. That year he joined His Majesty's Forces, and served until 1918 or the commencement of 1919, when he was given back his old position as order clerk in the Gas Department. Ball succeeded to the position of chief clerk in 1929, the accused filling for a time after his appointment two positions as chief clerk and order clerk. As would be gathered from these facts, he had the confidence of the whole of the Gas Committee. Unfortunately it had been now found that one year after coming from the Army he started fraudulent practices. Everybody who saw a document which had been initialed by him regarded it as genuine. Every month the Department had to deal with invoices and statements in very large numbers—between 30,000 and 40,000. Leonard Ball's signature in relation to these was regarded as a badge of honesty and accuracy. Ball had used the opportunity of pressure of work to start the alleged frauds in a small way, and, finding them successful, he gradually increased them. Of course, he could not do it by himself, and he had to get tradesmen alleged to be dishonest to assist him. It was alleged that he procured Allen, Gardiner, and Mullis to send in false invoices for goods alleged to have been supplied to the Gas Department but which had never been delivered. It might be asked how such false invoices could pass the Manager and others in authority. In a total of 30,000 to 40,000 documents each month, it was easy to slip in false invoices. The duty of the chief clerk when an invoice was tendered to him was to see that there had been a requisition in regard to which an order had been given. Then he compared the invoice with the "goods received" sheet.

Dealing with the properties which Ball had acquired, and the business transactions in which he had engaged, Counsel remarked that it had been found in September that, in addition to possessing 51 houses, the accused also had two establishments which were being conducted as ladies' outfitters' shops. Ball owned two other shops in a central part of the city; and he had been making advances to relatives—one advance being £300, and another £100. Allen built a house at Radcliffe for Ball, who sent bogus orders to him for goods for the Gas Department, which were paid for but never supplied. This had been going on for ten years, no less than £12,824 having been paid in this way. Ball had also similarly sent orders to other firms. Considerable consignments of goods obtained in this way and paid for by the Corporation were forwarded to Allen's yard and used by him in building the house for Ball at Radcliffe or upon some of his properties which Allen was repairing for him. In several instances, it was alleged, Allen, with Ball's connivance, charged the Corporation for timber which had already been paid for to other firms.

Among those in Allen's employ was a brother of Ball, who had acted as his book-keeper, and he would be called as a witness for the prosecution and give evidence as to the nature of certain entries in the book which had an important bearing upon the case. Allen had accumulated large sums of money. In three years, from 1927 to 1930, he supplied to Ball materials and labour amounting to £6741, for which Ball had paid nothing.

At the Guildhall, L. Ball had made a voluntary statement to the police, in which the following occurred. "It all started with a question of repairs to my own property. That would be in 1926, I think, or early 1927. Allen and I then arranged to use Corporation material on my property. The suggestion came from me. The same thing applies to Sissons as well. It all started in a small way. . . . Our method for obtaining this material was for me to send an order through to H. & M. Lewis (timber merchants) in my official capacity, and I informed them that the material would be collected by Allen. Lewis's account would come direct to the Gas Department, and I would certify it as correct and pass it for payment."

In another part of his statement, Ball said: "I arranged with Allen that he should share for all timber not used on my property and repair work on the basis of half-and-half. He would pay me generally in cash. We have also had slates and timber from Lewis's for repair work."

Details of dealings with Messrs. Woodhouse & Co.'s representative in Nottingham (Walter Ball) were afterwards given by Counsel, who suggested that money which had been irregularly received by that firm from the Corporation should be refunded. Walter Ball when apprehended stated that he had neither given nor received money from the Corporation.

The case of Deeley, who had described himself as an engineer, mill, and factory furnisher, was afterwards dealt with, the allegation being that he had been paid by the Corporation £5388 for goods never delivered, the fraud being effected by fictitious invoices, and Leonard Ball participating in aiding the commitment of the fraud. Gardiner was alleged to have defrauded the Corporation of £32,000, he being described by Counsel as one of the earliest conspirators with Leonard Ball, having been engaged in frauds extending over ten years. The frauds in this case, as in others, had been effected by means of bogus invoices. Counsel dealt afterwards with the cases of Mullis and Scotton, stating that the former was connected with the firm of Brown & Co., wholesale builders' merchants, and he was alleged to be responsible for an amount of £3256. Scotton was manager for H. & M. Lewis, Ltd., timber and slate merchants, and when questioned said his Directors knew nothing of the case. He denied that he was guilty in relation to either of the charges, which concerned a sum of £8100 paid by the Corporation. The Sissons, it was alleged, had been paid for repair work which had never been executed.

Mr. John Wilkinson's Evidence.

Mr. *John Wilkinson*, Engineer and General Manager of the Corporation Gas Department, afforded information as to the working of the undertaking. He stated that requisitions for goods came to the head office, and there, if they were governed by a contract or were for small amounts governed by price lists, the chief clerk handed the requisition to the order clerk. If the amount of goods required was exceptionally large, prices were obtained by competitive tender. The order had to be signed either by himself, the Assistant Engineer, or the chief clerk. When the goods were delivered to the various depôts, the gatekeeper there and the storekeeper would supply particulars to the Superintendent, who would hand them to a clerk who would enter the details in a "goods received" sheet. When the invoice was received it was handed to the chief clerk. In relation to Leonard Ball, Mr. Wilkinson said that until certain communications were made to him by the police he had always had the utmost confidence in him. Any statement which Leonard Ball had made was absolutely untrue in regard to the suggestion that he (witness) had said the Gas Committee was a very difficult body, several of whom were Socialists, and that those responsible for management were desirous that it should not be known that other goods were being purchased, such as bricks, slates, and chimney pots for repairing property belonging to the Corporation and its officials. It was not true that large purchases were made and paid for towards the end of the financial year, and goods held back. It was not true that payments were made so as to decrease the profits for the year. He had given definite instructions to the chief clerk and the gas accountant that payments must not be made until goods had been actually delivered. There was no truth in the suggestion that the Department was desirous of keeping the profits down as much as possible. If, however, the Department was likely to have a good year, and there were indications that markets were going against them, he would give instructions at any time for orders for certain material to be given. Over a series of years, these purchases would balance out. There was not necessarily any change in his managerial policy because it was the end of the financial year. If it had been said that it was his desire that certain members of the Gas Committee should be hoodwinked, and that he desired to keep back the fact that materials were being purchased for improving the comfort of managers and employees, there was not the slightest truth in it.

Cross-Examination.

Mr. Wilkinson was submitted to a lengthy cross-examination by Counsel for L. Ball, who suggested that payment was made for goods before their delivery.

Witness: I deny this absolutely.

Counsel: I suggest that, by your authority, when the end of the financial year came round you made purchases for the sake of keeping down profits. Never mind about the market conditions at all.

Witness: I say no, not with the intention of keeping down profits. I could not do that. What I have done is that, if I thought we were likely to have a bad following year, I have given orders for goods which would soon be required, to be invoiced for in the current year's account. But, whenever that has been done, direct instructions have been given to the order clerk that no payment should be made until the goods were actually delivered. That instruction was carried out on some occasions at any rate.

Witness said that he had seen an invoice that morning which distinctly stated "Keep cheque back." The Gas Department was a separate entity and liable to income-tax on its profits.

Mr. Lyons: I put it to you that you made these purchases through Leonard Ball repeatedly without any regard whatever either to prices or market conditions.

Witness: That is not exactly right.

Mr. Lyons: Tell me where it is wrong.

Witness: Whenever I have given instructions for a forward order it has mainly been because there may have been variations in prices. If I thought that the coming year's profits were likely to be adversely affected, and I could afford a little out of the current year's profits, I should give instructions from time to time to purchase goods to guard the following year's profits, so that anything that was invoiced between January and March would be charged against the profits of that year.

Asked by Mr. Lyons whether Ball was told to buy without regard to prices and market conditions, witness replied that the profits of the following year depended upon future market prices. In reply to further questions in cross-examination, witness denied that he had told Ball they had had a good year, and directed him to get some materials, and that he left it to him to see the persons personally. He did, however, direct Ball in regard to market conditions, fluctuations, and prices. He had checked Ball's bargains, and on many occasions satisfied himself he had bought according to his instructions. It was a deliberate lie to suggest that in a conversation with Ball in 1912 or 1913 he told him to put nothing in writing, but to see the people personally. Ball was only a junior clerk at the time, and he (Mr. Wilkinson) would never consult him. Witness denied that profits had been purposely kept down to reduce amounts for income-tax purposes; and he repudiated the insinuation that the figures had been manipulated for that purpose.

Mr. Ward, interposing, said he did not know what the Bench thought about the line of cross-examination.

The Chairman said that the Bench had listened patiently to the cross-examination in the hope of finding out what Mr. Lyons had in his mind, but they were still in the dark. If it was a matter of Inland Revenue, then it was for the Inland Revenue authorities to deal with.

Mr. Lyons said he hoped to show that the fictitious invoices were not invoices against him.

Mr. Ward said that Mr. Lyons' cross-examination had been as to orders given at the end of the financial year for delivery the following year. The charges were that goods for which orders had been given had never been delivered.

The Chairman said that Mr. Lyons had the right, and the Bench would give him all the latitude they could, to cross-examine and prove the innocence of his client, but Counsel must keep within that latitude.

Mr. Lyons: My case is that all these fictitious invoices are the result of the handiwork of the Department, and that they were done deliberately, and not for the benefit of my client.

Asked by Mr. Lyons whether he had had any personal dealings with those charged, Mr. *Wilkinson* replied: What do you mean by personal dealings?

Mr. Lyons: Did you ask Ball whether you owed anything to Allen.

Witness: No. He had asked Allen to send him invoices about August for what was owing by him; but that was months before he knew anything was wrong. Witness bought a motor-car from Gardiner, and now produced a receipt for it. He paid the full price for it, and did not get tradesman's credit.

The Chairman asked Mr. Lyons whether he was suggesting that the Corporation paid for the car or that there was collusion.

Mr. Lyons: I am suggesting that this car went on to some Corporation account.

The Chairman: We are getting outside what we consider the proper limits of the cross-examination.

Mr. Lyons: I say that the documents in question were advisedly fictitious, not for my client, but in pursuance of a Corporation scheme. (To witness): Have you had any discount from Gardiner that has been put across to the Corporation account?

Witness: Never.

Mr. Ward, interposing, said: Suggestions have been made against a gentleman of 19 years' standing in the Corporation service that these accounts have been paid out of Corporation money. Do I understand that Counsel is putting a question like that to an honest servant without any material being produced to substantiate it?

The Chairman: We have been impressed with the absolute frankness of Mr. Wilkinson in answering these questions. They appear up to the present to be only imputations, and unsupported by evidence.

Mr. Ward: That is a very improper thing.

The Chairman: I have allowed it because so far it has redounded all the way to the credit of Mr. Wilkinson.

Mr. Lyons: There must come a time when there is evidence to substantiate it.

Mr. Lyons (to witness): Has any information come to you from the inspection you have made of these documents that, with or without your knowledge, goods have been paid for out of Corporation money?

Witness: I have not the slightest knowledge of any money being paid on my behalf and the amounts going into the Corporation accounts.

The Chairman: I suggest that that is such a definite answer that these questions of Mr. Wilkinson's personal affairs could now be dropped.

Mr. Lyons retorted that the time would come later in the proceedings when he would be in the position to call evidence, if he so chose, upon those matters.

Mr. Ward: I protest; these questions are going to be reported in

the newspapers. I am sure that you will see that Mr. Wilkinson is cleared here and now.

The CHAIRMAN: We want the Press to take notice of what we say with regard to Mr. Wilkinson's answers.

ASSISTANT ENGINEER'S EVIDENCE.

Evidence was also given at considerable length by Mr. *Robert Morton Wilkinson*, son of Mr. John Wilkinson, and Assistant Engineer of the Gas Undertaking, who said that, in the absence of the Manager, it was part of his duty to deal with invoices for goods delivered; and when the invoices were put before him they should contain the initials of the chief clerk and the audit clerk. The initials would represent that the goods had been received and checked-off, and that the price had been checked. He (witness) would not have passed any invoice had he known the goods had not been delivered. During the time he had been Assistant Engineer until the charges became known to him he had every respect for and trust in Leonard Ball. He had never had any reason to question his honesty and integrity; and that was the feeling generally in the Department. The first time he knew anything about the matter was on the Monday prior to Ball's arrest on the following day.

In reply to Mr. Lyons, witness said he had heard the suggestion that invoices had been received and payments made before goods were delivered, but he had never signed them. It was news to him that there was any system in the Department whereby goods were ordered and paid for, and held back in delivery. At the end of 1929 and the beginning of 1930 certain alterations were being made to witness's house by Allen. One of the Sissons also did some work. He had no bill from Allen until he received one from an accountant after a deed of assignment had been made. The bill witness disputed, and sent back with his remarks.

Cross-examined: There was not the slightest truth in the innuendo that the Corporation had paid for any work done on his behalf.

Mr. *Richard Henry Mason*, Gas Accountant to the Corporation, also gave evidence, stating that he had never had reason to doubt Ball's honesty. If Ball's initials were upon any document, he had no cause to question its accuracy.

A whole day was again occupied on Thursday, Nov. 20, in the further hearing of the cases, and the magisterial investigation was then adjourned until Nov. 25.

Mr. *Mason* continued with the evidence at the third day's proceedings, explaining in considerable detail the procedure followed by the Department in relation to the payment of accounts. He had never drawn cheques in payment of sums charged on invoices if he had known that the goods had not been delivered. In the ordinary course of events he received information from Ball that goods had been delivered.

Asked in cross-examination by Mr. Lyons whether there was a regular audit of the accounts of the Gas Department, Mr. Mason said that the audit was carried out annually by the City Auditors.

Mr. LYONS suggested to witness that, as a matter of Departmental practice, he had discussed with Leonard Ball on several occasions before the end of the financial year what the position of the Department was, and that these discussions had always been in relation to good years.

Witness said this was so, but such discussions had no relationship to the idea of incurring fresh liabilities before the end of the year. He denied that it was the custom of the Department to pay for goods before delivery. He had had no discussion with Leonard Ball as to the Department's return in relation to income-tax. He would not discuss such a technical matter with him.

Re-examined by Mr. Ward, witness said that the City Auditors were Chartered Accountants, with a high reputation in the city.

Mr. WARD: The innuendo is that you were lending yourself to a practice to diminish profits so as to evade tax.

Witness: I have plenty of evidence to the contrary.

Torquay Company Not to Appeal.

It was announced at Paignton Police Court on Friday, Nov. 21, that the Justices had received a letter from the Torquay and Paignton Gas Company intimating that it was not the Company's intention to proceed with their appeal to the High Court against the conviction and fine of £20 in the recent prosecution by the Devon Sea Fisheries Committee for the pollution of navigable water by the discharge of oil at the gas-works.

Parliamentary Intelligence.

[From Our Special Correspondents.]

House of Lords.

Special Orders.

The Special Orders Committee met on Nov. 25 to consider the following Orders: Heathfield and District; Plymouth and Stonehouse; Stoke-on-Trent; Yorktown (Camberley) and District; Rochester, Chatham, and Gillingham.

The Glastonbury and the Clacton Gas Orders, which have also been referred to this Committee, will be considered later.

House of Commons.

There were no items of business affecting the gas industry.

REGISTER OF PATENTS

Purification.—No. 336,425.

BONNEMANN, F., of Essen-Ruhr.

No. 31,023; Oct. 12, 1929.

According to this invention, a process for the purification of gases containing ammonia and sulphuretted hydrogen wherein the latter is present in a greater proportion than that represented by the ratio $2NH_3 : 1H_2S$ is characterized by dividing the bulk of the gas containing sulphuretted hydrogen into two portions, of which one contains only so much sulphuretted hydrogen as can be combined with the available ammonia, concentrating the available ammonia in this portion, and eliminating sulphuretted hydrogen therefrom by combination with the ammonia. In this way, states the patentee, the desired theoretical ratio for the reaction between ammonia and sulphuretted hydrogen is obtained in a simple manner, and the divided portion of the gas containing sulphuretted hydrogen without any ammonia can be dealt with in the manner he describes.

Before the reaction of the ammonia with sulphuretted hydrogen, it is necessary to cool the gas in order to deposit any tar; and the divison of the gas stream is preferably effected after this cooling operation. As a preliminary step the crude gases may be cooled to separate ammonia and tar, and the ammonia thereafter driven off in gaseous form by treatment with lime, and added to the portion of the bulk from which sulphuretted hydrogen is to be eliminated by combination—this ammonia being thereby concentrated therein.

In a further step according to the invention, after the preliminary cooling step the remaining ammonia is separated from the portion of the divided bulk of the gases from which sulphuretted hydrogen is not to be eliminated by combination and is added to the other portion, this ammonia being thereby concentrated therein. The gases in the divided portion in which ammonia is not concentrated, after being freed from ammonia, may be treated in a separate plant for removal of sulphuretted hydrogen, and thereafter reunited with the other portion of the gases.

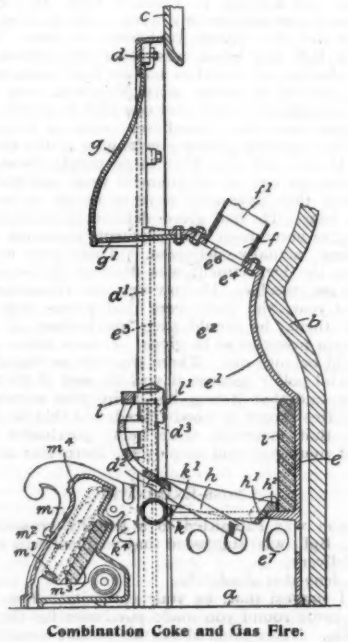
A hypothetical example is quoted in the specification.

Combination Coke and Gas Grate.—No. 336,824.

TURNER, I., of Richmond, Surrey.

No. 33,802; Nov. 6, 1929.

This invention consists of an interior grate for fitting to existing open fireplaces or with a view to adapting them to the burning of coke, a gas heating burner being provided for starting the coke fire. The accompanying drawing is a central section through the coke-burning grate, showing it provided with a separate gas fire at the front.



Combination Coke and Gas Fire.

The grate is shown as fitted in position in a fireplace comprising a hearth *a*, a back wall *b*, and a surround *c*, from which the coal-burning stove has been removed, the front frame *d* of the coke-

burning grate being of suitable height and width to fit against a surround c and close in the fireplace opening when standing upon the hearth a. The back portion of the grate is made as a casting comprising three connected panels, the central panel e having a convexly curved upper portion e^1 to clear the sloping wall b of the fireplace, and the side panels e^2 being set at a level to clear the side walls of the fireplace. The front edges of the back portion e are provided with lateral flanges e^3 for bolting to the sides of the frame d, these two parts being made in various standard sizes to suit the customary dimensions of open firegrate fronts in current use.

The top of the curved portion e^1 of the central panel is formed with an inclined register or flue plate e^4 connecting with the upper edges of the side panels e^2; this flue plate is provided with an opening e^6 upon which there is bolted a flanged fitting f to which there may be attached a length of flue pipe f^1, such as is employed in connection with gas stoves, extending upwards at an angle into the flue of the fireplace. A canopy g is bolted to the inner face of the front frame, extending forwards between the sides or jambs d^1 of the latter, the space behind this canopy being closed by a detachable plate g^1 bolted to the flue plate e^4.

The back portion of the grate is shown formed with a ledge e^7 upon which the coke-burning grate rests; alternatively the latter may be provided with legs to stand directly upon the hearth a.

The bottom of the coke-burning grate is formed by a sloping grid h extending downwardly from the front to near the back of the grate, with an oppositely sloping grid h^1 of narrow width at the back, both grids being cast in one, with a connecting rim portion h^2 which rests upon the ledge e^7; the bars of the front grid h run from front to back, and are preferably of width substantially equal to the spaces between them. At the rear ends of these sloping bars a clear space is left between them and the corresponding short bars of the back grid h^1 to allow free fall for the ash into a pan laid on the hearth a. Above the bottom grids and upon the ledge e^7 there are three fitted slabs of firebrick i, preferably of equal sizes with bevelled vertical edges, which form the back and cheeks of the coke-burning grate.

Along the front of the grate and below the front sloping grid h, there is provided a horizontal gas burner k with a number of burner nozzles k^1 which direct the flames between the bars of the front grid so as to ignite the coke. This lighting burner may comprise a mixing tube with a gas inlet at one end, the other end being of similar external shape in order to allow of reversing the burner for connection with a supply-point at either side of the fireplace, by way of an elbow-fitting k^2 or the like, for which alternative connections are provided, in the two sides of the frame d; this tube k is held in place by co-operating notches k^3 in the front edges of the back portion of the grate and in the rear inner edges or jambs d^1 of the front frame d. Either upon the burner tube or upon the frame (as shown), there are cast projections d^2 on which the front grid of the coke-burning grate rests. The same projections serve to support a basket front or guard l which retains the coke in position, the guard being also supported on hooks l^1 or the like which engage over a second pair of projections d^2 higher up the inner edges of the front frame.

A separate front heater m comprises a gas burner m^1 for the heating of radiant elements m^2 arranged in front of a firebrick reflector m^3, the whole being covered when not in use by means of an ornamental plate. The supply to the burner m^1 may be taken from the same source as that for the coke-lighting burner k, the connections to the burner m^1 being duplicated at the ends of the heater as in the case of the other burner k. If desired the gas fire m may be arranged to provide the lighting burner k, the latter being mounted for example at the position k^4 behind the reflector m^3.

Cooling of Coke Oven Gas.—No. 336,484.

HEINRICH KOPPERS AKTIENGESELLSCHAFT, of Essen-Ruhr.

No. 36,375; Nov. 27, 1929. Convention date, Sept. 27, 1929.

In modern coke oven plant, cooling is effected in the hydraulic main, whereby the main portion of the tar, and also part of the moisture content of the gas, are separated. For efficient benzole absorption, it is usual to cool the gas as much as possible, and for this purpose the so-called final cooler is introduced, which is served with a circulating quantity of cooled water. According to this present invention, the water passing out of the final cooler is subjected to a tar washing or treating process before it is re-cooled. Tar is capable of absorbing large quantities of naphthalene, and the water leaves the tar washer substantially free of naphthalene. As the quantity of naphthalene absorbed by the cooling water in one circuit through the final cooler is comparatively small when the tar washing process is adopted, blockage of the hurdles can be avoided with certainty, and also the formation of naphthalene deposits in the re-cooling plant.

An example of apparatus for carrying the invention into effect is illustrated in the specification.

Applications for Patents.

[Extracted from the "Official Journal" for Nov. 5.]

Nos. 32,146—32,952.

BARRALET, J. H.—"Automatic gas valves for geysers." No. 32,222.
BECKER, A. C.—"Gas burner for gas-firing installations." No. 32,260.
NAAMLOOZE VENNOOTSCHAP DE NEDERLANDSCHE GASMETERFABRIEK (v. WILSON MAATSCHAPPIJ VOOR AANLEG VAN GAS EN WATERLEIDINGEN.—"Prepayment meters for gas." No. 32,396.
NEW GEYSERS, LTD.—See Barralet, J. H. No. 32,222.
PRATT, A.—"Gas cock." No. 32,454.
SIMPSON, S.—"Gas governors." No. 32,509.
TAYLOR, E.—"Coke crushers." No. 32,582.
TOWNLEY, C.—"Gas fires." No. 32,196.
WILLEY & CO., LTD.—See Simpson, S. No. 32,509.

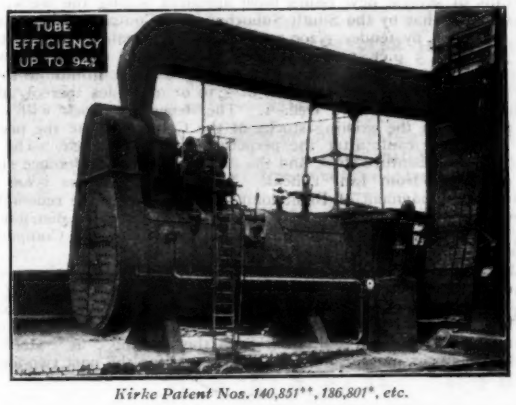
NOW STANDARD—

SPENCER-BONECOURT
PATENT WASTE HEAT
BOILERS

NO. 1. 1 TON STEAM FROM WASTE HEAT FOR EVERY 1¼ TONS OF COAL CARBONISED is being obtained from waste heat alone with Spencer-Bonecourt Patent Waste Heat Boilers.

NO. 2. 5¼ lbs STEAM PER LB OF COKE put into the producers is being obtained from waste gases at 700°C. with these Boilers.

NO 3. 4½ lbs STEAM PER LB OF COAL put into the producers is being obtained from waste gases at 600°C. with these Boilers.



*Kirke Patent Nos. 140,851**, 186,801*, etc.*

NO. 4. 5 LARGE LANCASHIRE BOILERS FIRED WITH COKE & COKE BREEZE HAVE BEEN SHUT DOWN BY 2 SMALL SPENCER-BONECOURT PATENT WASTE HEAT BOILERS

NO. 5. No Economisers used in any of the above performances.

NO. 6. WATER GAS PLANTS have been fitted with these Boilers.

NO. 7. 14 REPEAT CONTRACTS have been received from One Firm alone.

NO 8. HORIZONTAL, VERTICAL & INCLINED RETORTS. ALSO VERTICAL AND INCLINED CHAMBERS have been fitted with these boilers.

NO. 9. £12,000 PER ANNUM RETURN ON £6,000 ORDER is being obtained by one customer.

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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The dulness displayed in most departments of the Stock Exchange last week was reflected in the Gas Section, the volume of business being a trifle less than usual. Prices, however, were not affected, and, apart from one *ex* div. reduction, all changes in quotations were on the upgrade. Alliance and Dublin and South Metropolitan ordinary stocks each gained 1 point to 96-99 and 104-106 respectively. In the case of the latter Company, this is an increase of 5 points compared with the corresponding week a year ago; there being no change in respect of the former Company. At the local Exchange, Liverpool 7 p.ct. preference strengthened 1½ points to 99-101. This stock, which was issued at par in January, 1922, is redeemable at par (*a*) on June 30, 1941, or (*b*) in whole or in part on or after June 30, 1931, on six months' notice by the Company. At the present price, therefore, the yield is a round 7 p.ct. Two other preference stocks to show improvements were the Aldershot 4 p.ct. and the Newcastle and Gateshead 4 p.ct., the former by 1 point to 73-76, and the latter (at the local Exchange) by ½ to 72-73. Bournemouth "B" 7 p.ct. ordinary shares gained ¼ to 12¼-13.

Details of several new issues have appeared during the week, the largest being that by the South Suburban Gas Company. The Company is selling by tender £200,000 5 p.ct. perpetual debenture stock and £300,000 5 p.ct. perpetual preference stock; the former at a minimum price of £99 p.ct., and the latter at a minimum price of £92 p.ct. Tenders, in amounts of £10 or multiples thereof, must be delivered on or before Dec. 1. The debenture stock will rank *pari passu* with the existing stocks of the Company, and the preference stock will rank after the perpetual debenture stock. The interest on the debenture stock and the dividend on the preference stock will accrue as from Jan. 1 next. The proceeds of the issue are required for repayment of Bank loan (which includes the redemption of debenture stock in June last) and to meet the extra distribution costs necessitated by the continual rapid growth of the Company's business.

Other issues are those of the Tunbridge Wells Gas Company—viz., £25,000 5½ p.ct. perpetual debenture stock at a minimum price of £105 p.ct.—and the Bognor Gas and Electricity Company—viz., £20,000 additional ordinary consolidated stock "A" at a minimum price of £120 p.ct. This stock will rank with the existing "A" stock on which 8 p.ct. per annum has been distributed for the past two-and-a-half years.

Coal Markets.

The position of the markets at the moment is difficult to summarize. In view of the threats of trouble in the coalfields, there appears to have been some increase in prompt demand for export, but an examination of this feature reveals that it is chiefly for coals previously bought under contract, which are being taken out with more regularity than of late, rather than any demand bringing new business. In this respect, trade is suffering under many disadvantages. There is abundant evidence that the foreigner is not worrying in the least about possibilities of a stoppage. There are abundant supplies of Continental coal offering at lower prices than British, and rather than risk the dislocation of supplies, the foreign consumer is fixing up elsewhere for next year. In any case, the continued uncertainty about prices and conditions of the marketing schemes render it extremely difficult to do business ahead.

Tenders from the Newcastle market for a Norwegian State Railways contract between now and next April were about 2s. a ton above Poland, which accordingly received the order for 60,000 tons. Westphalia has obtained an order for Naples Gas-Works for 25,000 tons, again at 2s. below Durham prices. On the other hand, Newcastle exporters have contracted to supply Amsterdam Gas-Works with 80,000 tons, but here the c.i.f. price leaves about 12s. 3d. f.o.b. for the coal, or a shilling below current rates.

Quotations for coals are 15s. 6d. to 16s. for Wear specials, and about 15s. for best qualities. Both these have hardened distinctly under day-to-day demand. Seconds and others are variable at 12s. 6d. to 13s. 3d. Yorkshire screened gas for export is 16s. 6d. to 18s.

Some districts report a slackening of export demand for gas coke, but home trade is good, and the price is maintained at round 21s. 6d.

Contracts Advertised To-Day.

Carbonizing Plant.

The Gas Committee of the Skipton Urban District Council invite tenders for the reconstruction of a horizontal retort bench. [Advert. on p. 624.]

Gas Oil.

The Gas Committee of the Mansfield Corporation invite tenders for the supply of gas oil. [Advert. on p. 624.]

Purifiers, &c.

The Lancaster Corporation invite tenders for the supply of purifiers, &c. [Advert. on p. 624.]

Current Sales of Gas Products.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 24.

The values of tar products remain unchanged, and are as follows: Pitch, 47s. 6d. per ton f.o.b.

Creosote, for export, 6d. to 6¼d. per gallon f.o.b.

Pure toluole, about 2s. per gallon; pure benzole, about 1s. 8d. per gallon; 95/160 solvent naphtha, about 1s. 5d. per gallon; pyridine bases, about 3s. 9d. per gallon.

All prices for spirits are *ex* sellers' works.

Tar Products in the Provinces.

Nov. 24.

The average prices of gas-works products during the week were: Gas-works tar, 20s. to 24s. Pitch—East Coast, 46s. f.o.b. West Coast, Manchester, Liverpool, Clyde, 46s. f.o.b.* Toluole, naked, North, 1s. 6¼d. to 1s. 7¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 2¼d. to 1s. 2¾d. Heavy naphtha, North, 11d. to 1s. Creosote, in bulk, North, liquid and salty, 3½d. to 3¾d.; low gravity, 1¼d.; Scotland, 3½d. to 3¾d. Heavy oils, in bulk, North, 5¼d. to 6d. Carbolic acid, 60's, 1s. 4½d. to 1s. 6d. Naphthalene, £10 to £12. Salts, £3 to £5, bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port, it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Nov.* 22.

The market continues very quiet, and stocks of most products are high. A certain amount of interest is being taken in tar acids as values are easier.

Pitch.—Few orders are being placed. Export value is lower at 42s. 6d. to 45s. per ton f.o.b. Glasgow, while home price is unchanged at 42s. 6d. per ton f.o.r.

Refined tar to Ministry of Transport Specification is now being offered freely for delivery next season at 2¼d. to 3¼d. per gallon at makers' works in buyers' packages.

Creosote.—Quotations are steady, and there is a fair inquiry for certain grades. B.E.S.A. Specification is 2¾d. to 3¼d. per gallon; low gravity, 3d. to 3¼d. per gallon; and neutral oil, 3d. to 3¼d. per gallon—all f.o.r. makers' works in bulk.

Cresylic.—There are more inquiries as quotations have been reduced in this area. Pale, 97/99 p.ct., 1s. 6d. to 1s. 7d. per gallon; dark, 97/99 p.ct., 1s. 5d. to 1s. 6d. per gallon; and pale, 99/100 p.ct., 1s. 8d. to 1s. 9d. per gallon; all *ex* makers' works.

Crude naphtha.—Quotations are steady at 4d. to 4¼d. per gallon in bulk f.o.r. works.

Solvent naphtha.—Very little business is being transacted. 90/160 is 1s. 2¼d. to 1s. 3d. per gallon, and 90/190, 1s. to 1s. 0¼d. per gallon.

Motor benzole.—Value remains at 1s. 4d. to 1s. 4½d. per gallon, but few orders are being placed.

Pyridines remain unchanged; 90/160 being nominal at 3s. to 3s. 3d. per gallon.

Benzole Prices.

The following are considered to be the market prices at the present time:

	s. d.		s. d.	
Crude benzole	0 7½	to 0	8½	per gallon at works
Motor ,,	1 3	,, 1	4	,, ,, ,,
Pure ,,	1 7½	,, 1	8½	,, ,, ,,

Trade Notes.

Rotary Air Compressors and Vacuum Pumps.

From Messrs. Bernard Holland & Co., of 17, Victoria Street, S.W. 1, we have received the firm's pamphlet on their rotary compressors and vacuum pumps.

Gledhill-Brook Time Recorders.

That quality pays has been emphatically demonstrated by Gledhill-Brook Time Records, Ltd., Huddersfield, who, following a previous order for 138 G.B. Time Recorders have just received a repeat contract for 149 of the same machines for use in Admiralty dockyards. The same firm have further obtained an order from the Overseas Trade Department to supply all cash registers that will be required (between 50 and 60) at the British Empire Exhibition to be opened by the Prince of Wales in Buenos Aires next March.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Nov. 21.	Rise or Fall on Week.	Transact'ns Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 14	5	5	Aldershot 5 p.c. max. C.	73—78	..	74½
422,992	,,	,,	4	4	Do. 4 p.c. Pref.	73—76	+1	74½
1,551,868	,,	Oct. 9	7½	7½	Alliance & Dublin Ord.	96—99	+1	97—99
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	64—67	..	..
522,655	,,	Aug. 28	7	7	Barnet Ord. 7 p.c.	107—110	..	109½—110
200,000	1	Oct. 23	1/4½	1/7½	Bombay, Ltd.	15/6—17/6	..	..
174,500	10	Aug. 14	9	9	Bournemouth 5 p.c.	14½—15½	..	..
500,050	10	,,	7	7	Do. B 7 p.c.	12½—13	+½	..
439,160	10	,,	6	6	Do. Pref. 6 p.c.	11—11½	..	..
50,000	Stk.	June 26	3	3	Do. 3 p.c. Deb.	58—61	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	77—80	..	..
357,900	,,	Aug. 28	7½	7½	Brighton & Hove 6 p.c. Con.	112—117	..	114—114½
971,880	,,	,,	6½	6½	Do. 5 p.c. Con.	101—104	..	103—104
1,287,500	,,	July 24	5	5	Bristol 5 p.c. max.	92½—93½a	..	..
855,000	,,	Sept. 25	8	7	British Ord.	108—113	..	111½
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.	112—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	75—78	..	..
450 000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	97—100	..	..
100,000	,,	June 26	5	5	Cambridge 5 p.c. Deb.	97—100	..	..
100,000	10	May 22	6	10	Cape Town, Ltd.	9—10	..	..
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref.	6½—7½*	..	..
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb.	71—76	..	..
626,960	,,	July 24	6	6	Cardiff Con. Ord.	95—98	..	..
287,860	,,	June 26	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
157,150	,,	Aug. 14	6½	5	Chester 5 p.c. Ord.	86—91b	..	..
98,936	1	Oct. 9	†2/-	†2/-	Colombo, Ltd. Ord.	32/—34/-	..	..
24,500	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	18/—20/-	..	..
609,204	1	Oct. 9	1/9½	1/4½	Colonial Gas Assn. Ld. Ord	16/6—18/6	..	..
296,058	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	18/—20/-	..	..
2,073,280	Stk.	July 24	7	6	Commercial Ord.	94—97	..	95—95½
475,000	,,	June 26	3	3	Do. 3 p.c. Deb.	58—61	..	..
787,560	,,	Aug. 14	7	7	Croydon sliding scale	105—108	..	..
453,100	,,	,,	5	5	Do. max. div.	81—84	..	..
542,270	,,	Aug. 14	10	7	Derby Con.	115—125e	..	..
55,000	,,	June 26	4	4	Do. Deb.	65—70e	..	..
209,000	,,	Aug. 28	5	5	East Hull Ord. 5 p.c.	69—71	..	..
1,002,180	,,	Sept. 25	†7g	†4	European, Ltd.	100—110	..	100—105
18,629,125	,,	July 24	5½	5½	Gas Light & Coke 4 p.c. Ord.	19/6—20/-f	..	19/6—19/10½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	63—65	..	64½
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	79—82	..	80—81
5,602,620	,,	June 26	3	3	Do. 3 p.c. Con. Deb.	60—63	..	..
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	101—104	..	102½—103
161,460	,,	Sept. 11	10	10	Harrogate Cons. 10 p.c. max.	155—160	..	..
82,500	,,	Aug. 28	7	7	Hastings & St. L. 5 p.c. Conv.	97—102	..	..
268,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	76—81	..	..
70,000	10	Oct. 9	½	10	Hongkong & China, Ltd.	13—14	..	..
218,200	Stk.	Aug. 14	6	6	Hornsey Con. 3½ p.c.	88—91	..	..
2 438,594	,,	Nov. 6	25	15	Imperial Continental Cap.	340—360*	..	340—350
223,180	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	80—85	..	..
235,242	,,	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord.	123—128	..	125—125½
2,145,907	,,	Aug. 14	6	6	Liverpool 5 p.c. Ord.	95½—96½b	..	..
600,000	,,	Sept. 25	7	7	Do. 7 p.c. Red. Pref.	99—101b	+1½	..
165,736	,,	Aug. 28	8	9	Maidstone 5 p.c. Cap.	120—125	..	..
69,480	,,	June 26	3	3	Do. 3 p.c. Deb.	55—58	..	..
75,000	5	June 26	†10	†10	Malta & Mediterranean	5½—6	..	5½
892,000	—	Oct. 1	5½	5½	Melrop'litan (of Melbourne) 5½ p.c. Red. Deb.	88—91	..	..
675,000	Stk.	Nov. 20	†8	16	Montevideo, Ltd.	100—110*	..	103½
2,061,315	,,	July 24	5‡	5	Newcastle & Gateshead Con.	16/3—16/9d/f	..	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	72—73d	+½	..
691,705	,,	June 26	3½	3½	Do. 3½ p.c. Deb.	67½—68½d	..	..
169,940	,,	Aug. 28	7½	7½	North Middlesex 6 p.c. Con.	115—120	..	..
396,160	,,	Aug. 14	5	5	Northampton 5 p.c. max.	76—81	..	..
300,000	,,	Nov. 20	7	9	Oriental, Ltd.	104—109*	−4	105
60,000	5	18 My., '15	—	—	Ottoman	0—½	..	..
205,162	Stk.	June 26	8	8	Plym'th & Stonehouse 5 p.c.	110—115	..	..
424,416	,,	Aug. 28	8	8	Portsm'th Con. Stk. 4 p.c. Std	107—112	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	77—80	..	..
186,000	100	June 2	4	4	Primitiva 4 p.c. Red. Deb.	96—99	..	..
677,837	Stk.	July 24	4	4	Do. 4 p.c. Red. Deb. 1911	83—86	..	84—85
371,496	,,	June 26	4	4	Do. 4 p.c. Cons. Deb.	83—86	..	..
150,000	10	Sept. 25	6	6	San Paulo 6 p.c. Pref.	8½—8¾	..	..
1,736,968	Stk.	Aug. 28	6½	6½	Sheffield Cons.	104—106e	..	..
95,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—78e	..	..
90,000	10	June 5	†4	†5	South African	4—6	..	..
6.709,895	Stk.	Aug. 14	7½	5	South Met. Ord.	104—106	+1	104—105½
500,000	,,	,,	6	6	Do. 5 p.c. Irred. Pf.	111—114	..	113—114
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	60—63	..	..
734,000	,,	Sept 11	6½	6½	Do. 6½ p.c. Red. Db.	99—102	..	..
91,500	,,	Aug. 14	8½	8½	South Shields Con.	105—107d	..	..
1,543,795	,,	July 24	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	104—105
468,827	,,	June 26	5	5	Do. 5 p.c. Deb.	97—100	..	..
647,740	,,	Aug. 28	5	5	Southampton Ord. 5 p.c. max.	75—78	..	..
121,275	,,	June 26	4	4	Do. 4 p.c. Deb.	76—79	..	..
179,014	,,	July 24	8	8	Sutton Ord.	115—120	..	..
94,500	,,	June 26	5	5	Do. 5 p.c. Deb.	96—99	..	..
250,000	,,	Aug. 28	7	7	Swansea 7 p.c. Red. Pref.	98—101	..	..
200,000	,,	June 26	6½	6½	Do. 6½ p.c. Red. Deb.	102—105	..	..
1,076,490	,,	July 24	6‡	6‡	Tottenham District Ord.	102—106	..	..
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95—98	..	..
199,005	,,	June 26	4	4	Do. 4 p.c. Deb.	77—80	..	..
182,380	10	30 Dec., '12	—	—	Tuscan, Ltd.	2—3	..	..
85,701	Stk.	Sept. 25	6	6	Do. 6 p.c. Red. Deb.	73—78	..	..
209,094	,,	Aug. 28	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	95—100	..	..
88,330	,,	,,	5	5	Do. 5 p.c. pref.	88—93	..	..
1,180,970	,,	July 10	—	7	Wandsworth, Wimbledon, and Epsom Cons.	108—113	..	108½
200,000	,,	,,	5	5	Do. 5 p.c. Pref.	91—94	..	..
488,344	,,	June 26	5	5	Do. 5 p.c. Deb.	99—102	..	101½—102

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle. e.—Sheffield. f.—The quotation is per £1 of Stock. g.—Paid on £10 shares. *Ex. div. †Paid free of income-tax. ‡For year. § Div.=10 p.ct. p.a. less tax and less tax on interim dividend.

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Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

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Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

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G.J. 3.12.30.

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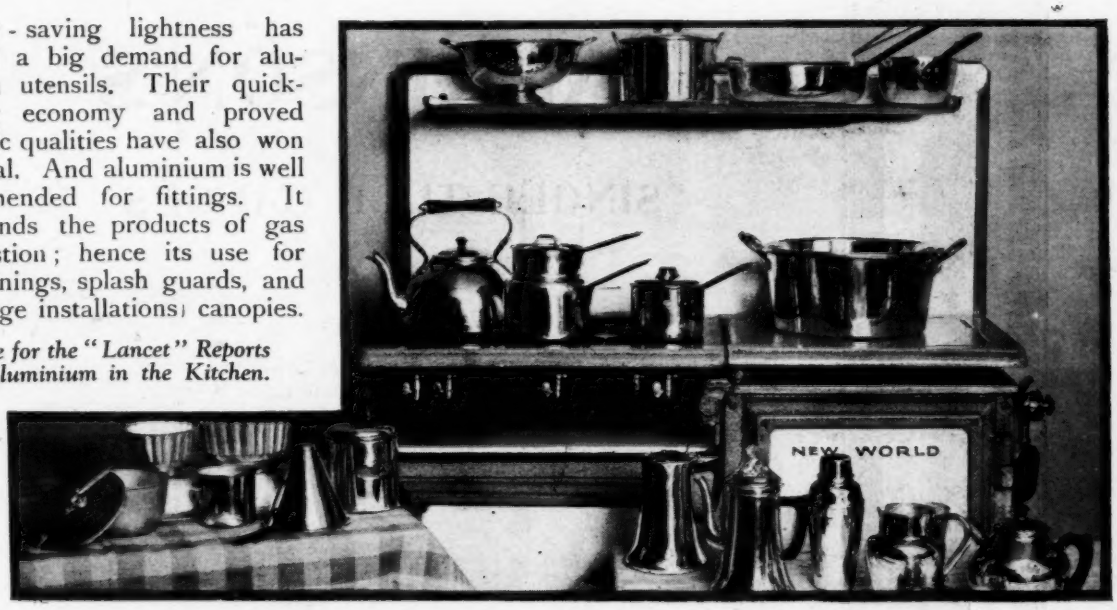

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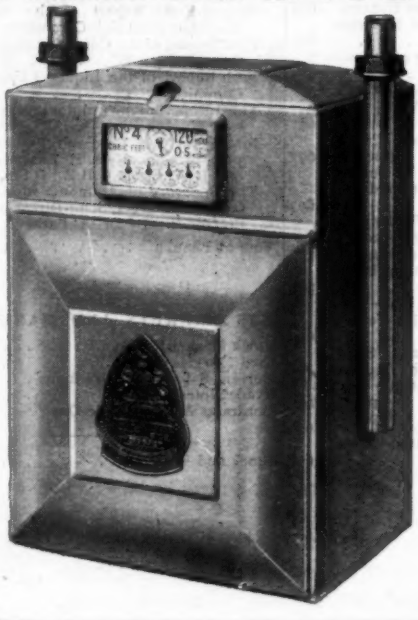

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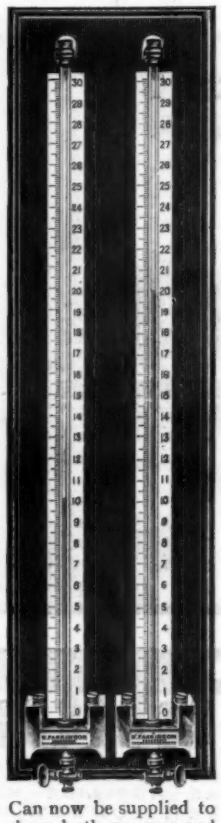

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